

**ANGLIA RUSKIN UNIVERSITY**

**FACULTY OF SCIENCE AND TECHNOLOGY**

**INVESTIGATING THE IMPLEMENTATION OF A REDESIGNED ERP SYSTEM IN  
NIGERIA MANUFACTURING SECTOR.**

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of a Doctor of Philosophy (PhD)

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## ABSTRACT

Enterprise resource planning (ERP) systems are a core software program that organisations can use to integrate, manage, and coordinate information. The ERP system supports organisations to manage business processes within a single database. ERP technology is at the core of many organisations in Europe, and it is used in facilitating organisational performance. The Nigeria manufacturing organisations (NMOs) quickly understand the urgent need to adopt ERP technology. However, the industry is yet to realise the precise impact of ERP system adoption. Despite ERP adoption within the Nigeria manufacturing organisations, the sector's contribution to the country's Gross Domestic Product (GDP) is still very minimal. Hence, the industry is yet to grasp the efficacy of ERP system. The purpose of this study is to investigate what hinders ERP implementation success and optimising NMOs organisational performance. Mixed research method is used, which involves the qualitative and quantitative research approach. This method contributes immensely towards a comprehensive data collection and analysis. This research shows that some of the main factors that hinder ERP implementation success include improper ERP project management, corrupt practices at different levels, and lack of performance measurement. The conclusion and recommendation suggest a structured lean six-sigma procedure towards ERP implementation projects and effective performance measurement post-implementation. Also, Nigeria manufacturing workers need adequate knowledge transfer, education, and training to implement and navigate such advanced integrated systems. Finally, to tackle corruption, blockchain technology integration into ERP system is examined (B-ERP). This integration has reflected the positive impact of the B-ERP system on an organisation's performance as seen in the validation study. Further research can look into replicating this integration in other sectors in Nigeria.

## LIST OF ABBREVIATIONS

B-ERP – Blockchain Enterprise Resource Planning  
BOM – Bill of Materials  
BPR – Business Process re-design/re-engineering  
CMF – Content management framework  
CRM – Customer relationship management  
CSF – Critical Success Factor  
DMAIC – Define Measure Analyse Improve and Control  
DMBS – Database management systems  
EGRP – Economic growth and Recovery Plan  
ERP – Enterprise Resource Planning  
FA – Financial accounting  
GDP – Gross Domestic Product  
GEMC – Generic enterprise modelling concept  
GUI – Graphical user interface  
HRM – Human resource management  
I.T – Information Technology  
IAAS – Infrastructure as a service  
ICT – Information and Communication Technology  
IS – Information system  
KPI – Key Performance Index  
MAN – Manufacturers Association of Nigeria  
MRPI – Material requirement planning  
MRPII – Manufacturing Resources Planning  
NMO – Nigeria Manufacturing Organisation  
OSS – Open Source Software  
PAAS – Platform as a service  
ROI – Return on investment  
S&M – Sales and marketing  
SAAS – Software as a service  
SCM – Supply chain management  
SME – Small and Medium Enterprise  
SOA – Service-oriented architecture  
SPOF – Single point of failure  
SPSS – Statistical Package for the Social Sciences  
TOE – Technology Organisation and Environment  
XML – Extensible mark-up language

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## DECLARATIONS

This is a declaration that this body of work was developed and written by me. All data were collected and analysed by me, with supervision by academic and non-academic staff. Any part of this thesis has not been previously submitted to this or any other higher institution for the purpose of a degree. Therefore, this thesis copyright belongs to the author, under the conditions of the United Kingdom Copyright Act, which is incorporated by Anglia Ruskin University. Relevant contact and reference should be made towards the use of any material derived from this thesis.

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## CHAPTER 1

### INTRODUCTION

#### 1.1 Introduction

The ongoing global industrial development and growth has brought about the need for more information technology (IT) adoption in developing countries. Nigeria is known to be a crude oil sustaining country for decades. However, the Nigeria government has been working hard to diversify the country's economy. The manufacturing sector is one of the focus of the government in the newly proposed "economic growth and recovery plan" (EGRP) policy (Adeniran et al., 2017; Suberu et al., 2015). Given the significance of manufacturing towards the country's economic recovery and sustainability.

In Nigeria, experts such as managers, entrepreneur, consultants, governmental bodies, and the researchers have expressed their concern on the prominent issue of effectiveness, efficiency, and productivity within the manufacturing organisations. Which ranges from the length at which businesses utilise their resources, such as raw materials, machine, people, finance, and so on (Raji, 2018; Solomon & Fidelis, 2018). The effectiveness of an organisation internal processes can be directly related to the efficiency of an organisation. Efficiency can be defined as performing activities in the best manner, i.e. "doing things right". Efficiency in-turn increases patronage of products and services rendered (Jayaganesh & Shanks, 2009).

According to researchers report, ERP has displayed massive advancement in managing resources in various sectors (Alam & Uddin, 2019). Enhances the automation of business processes and establishing efficiently shared information link across the organisation. These include sales report in real-time to the suppliers, business partners, and even customers (Bajwa & Garcia, 2004). Enterprise resource planning systems are improved daily; research will always improve its capacity and efficiency. According to Kumar et al., (2003), integrated

information system that can be used to co-ordinate information and automate repetitive processes across an organisation can be called an ERP system.

This research considers the need for a successful ERP adoption within the Nigeria manufacturing environment. Therefore, focused on investigating the implementation of a re-designed ERP system. The study addresses the impact of an ERP system on business performance. Also, factors that influence ERP adoption and ERP critical success factors are considered. Next is to develop and propose an implementation model. This chapter provides an overview of the study such as ERP background, research problem, aims, objectives and questions. A thesis outline is also presented in this chapter as a guide through the write-up.

## **1.2 Background**

One can trace Enterprise resource planning (ERP) history back to "Inventory control packages". Which rapidly was developed into "Material requirement planning" (MRPI) as early as the 1940s. The system brought about a drastic improvement in the manufacturing industry (Group, 2015). The software helped, especially in supply chain management. It reduces costly human efforts by providing intelligent management, real-time business, eliminating overstocking, logistics management, and unnecessary paperwork. MRP software has helped the managers ensure that enough products are in stock for delivery to customers and raw materials are also available in-stock for production (Saad Munami, 2014).

The software was adopted for the first time by a company named Black & Decker in 1964. They used mainframe computers to disseminate information. The information includes the bill of materials for finish products and the planning and production purchase for components. MRP is fundamentally designed based on three fundamental facts; namely, i) what is needed? ii) When is it required? iii) Lastly, in what quantity it is needed? The concept is sufficient to

enable managers to predict how much capability is necessary to allocate an appropriate production time.

The advancement of MRP in the 1980s led to new and innovative Manufacturing Resources Planning (MRPII). The concept proved itself at this time to be very successful. It allowed organisations to control and plan their resources better using valid schedules. According to the words of Minty (1998) "the improvement in cash flow projections alongside with the management projections, positively impact marketing and finance". MRPII make provisions for the information about the cost of production alongside the number of materials, labour and machine time (Saad Munami, 2014). MRPII stretches the info towards the finance and accounting department, symbolising its advancement compared to the initial MRP. However, it has been seen that majority of the organisations that implemented MRPII encountered specific problems at that time. This reason is that it is more robust compared to the previous version. Hence, it requires adequate training and constant use for staffs to acclimatise themselves with the software.

Enterprise resource planning later emerged in the 1990s, after MRPI and MRPII. Advanced software considers the entire organisation by integrating functional units (Saad Munami, 2014). Many of the organisations that own the MRPII software migrated to the modern ERP system. ERP software applies to various industry types regardless of large, small, and medium organisations (SME). Electronic business environment changes more rapidly under the globalisation. Hence, small and medium-sized companies also become bigger and bigger. The legacy business systems may not be flexible enough to adapt this change, and the discordance between business and information systems in the organisation may occur.

ERP system is a productive enterprise framework that allows organisations to exchange facilities within integrated systems using a unified or centralised database. Since information

technology (IT) defines the essence of unified communication. The role of ERP technology towards IT development cannot be underrated. It also stresses the importance of integrating various components such as the computers, telephones, database storage system, using software (Adebayo et al., 2013; Aremu & Shahzad, 2015).

### **1.3 Research Problem statement**

Nigeria economy largely depends on crude oil production, but the 2014 global oil crisis forced the country's economy into a massive recession (Solomon & Fidelis, 2018). This long-term recession prompted the Ministry of Budget and Planning under President Muhammadu Buhari's leadership to release an Economic Recovery and Growth Plan (EGRP) in March 2017 to revive its economy within 2017-2020 and even beyond. The 4-year plan to generate sustainable growth, the economic transformation will allow for increased productivity and economy diversification (Adeniran et al., 2017). A significant part of EGRP is improving the manufacturing sector.

The Nigerian manufacturing sector has been underperforming over the years. The industry has started to see some improvement in recent years due to increasing awareness and adoption of information technology (Raji, 2018). There was negative growth until 2015-16, but there was only one such instance in 2017; in the third quarter. Incentives by the government are also beginning to encourage more investors interest. According to official data, 9.3% of GDP; Nigerian manufacturing sector grew 3.4% year-on-year in the first quarter of 2018, an improvement from 0.1% y/y in Q4 2017 and -2.9% y/y in Q3 2017. last time something close to such growth in the period since Q1 2016, was in Q1 2017 when the sector grew by 1.4% y/y. For the whole of 2016 till then, the industry recorded negative growth (Recovery, 2017).

The manufacturing sector is one of the government's critical priorities focusing on the four-year Economic Recovery and Growth Plan (ERGP). Other stated preferences are stabilising the

macroeconomic environment, energy sufficiency, improvement of transportation infrastructure, the achievement of food sufficiency and national security. To ensure optimal execution of the ERGP, the Nigerian government resolved in August 2017 to conduct sector or focus labs "designed to tackle complex challenges by bringing together all stakeholders to identify the root causes of the difficulties within an industry and brainstorm on ideas and resources to solve them (Adeniran et al., 2017).

The problem or challenges in this aspect is corruption practices at every management level, such as data manipulation and non-transparency of information. According to Adebayo et al., (2013); Chete et al., (2014), corruption practices have defeated the intentions of industrialisation and ICT adoption in Nigeria. The potentials of increased productivity and an overall turnover of manufacturing organisations are not actualised. Hence, this research seeks to investigate a suitable implementation of Enterprise resource planning (ERP) system to enhance Nigeria's manufacturing sector's productivity and tackle corruption concerns in the industry. However, there is always a gap that exists between generic system design and individual organisation's requirement. ERP packages and generic design have inferred background biases according to, country, sectors, industry, etc. Therefore, this study investigates the Organisational Performance situation within the manufacturing sector to examine and propose an ERP implementation model suitable for Nigeria's manufacturing companies.

**Tab. 1.1 Brief description of the research problem**

Issues to be considered
-------------------------

<b>Research Issues</b>	<b>Brief Description</b>
Nigerian manufacturing sector contribution to economy	The level of MNO contribution to the Nigeria economy is too little.
Technology impact on business performance.	There is a need to understand the clear impact of Enterprise Resource Planning system on the Nigeria manufacturing organisational performance.
Information quality and corrupt practices	There are still a lot of Information discrepancies within functional units and the level of corruption practices is quite enormous.

#### 1.4 Research Questions

- ❖ What is the degree of ERP system knowledge within the Nigeria Manufacturing Organisations?
- ❖ What are the factors influencing ERP adoption within the Nigeria Manufacturing Organisations?
- ❖ What are the most challenging functional units within the Nigeria Manufacturing Organisations?
- ❖ What are the critical success factors for ERP implementation and their impact on Nigeria manufacturing Organisational performance?
- ❖ How can integration of ERP system and Blockchain technology improve the performance of the Nigeria Manufacturing Organisations?
- ❖ Considering the factors influencing ERP adoption within the Nigeria manufacturing organisations, will there be a significant classification of impact on business performance for implementing a Blockchain-ERP system within the Nigeria Manufacturing Organisations.

The research questions were guided and developed based on the six points listed below (Shona, 2018).

1. **Focused on a single problem or issue:** Investigating the adoption and implementation of ERP in the Nigeria manufacturing sector.
2. **Investigation via primary and secondary sources:** This study questions can be answered using direct and secondary sources. For the sake of in-depth knowledge, this research questions are assessed using the primary sources. The primary source is the data the researcher collected in person. At the same time, secondary sources are the data that has already been ordered by someone else.
3. **Feasible to answer within the timeframe:** The research questions were answered using quantitative and qualitative methods. It was designed to be within schedule but crept a bit due to the pandemic.
4. **Specific enough to answer thoroughly:** The questions are specifically designed to collect pieces of information about how ERP adoption can increase production and profitability within the Nigeria manufacturing organisations (NMO).
5. **Comprehensive enough to develop the solutions:** The research questions were able to show the extent of ERP adoption and implementation. ERP system adoption impact on productivity and profitability, factors that influence ERP system adoption and desirable IS features within the Nigeria manufacturing organisations NMOs.
6. **Relevant to the study and society:** This research relates to the field of science and technology and can be broadly associated with Nigeria's economic growth and recovery plan (EGRP).

### 1.5 Aim and Objectives

The industrial sector in Nigeria encompasses manufacturing, mining, and utilities. This sector provides only 6% of the country's economy. Manufacturing sector which is the focus of this

study accounts for only 4% contribution to the country's economy in 2011, and by the first quarter of 2018, its contribution has already dropped to 3.4% (Raji, 2018; Chete et al., 2014).

### 1.5.1 Aim

- ❖ To Investigate how ERP re-design can enhance productivity and overall organisational performance within the Nigeria manufacturing sector towards improving the country's economy.

### 1.5.2 Objectives

- ❖ To study the extent of advance Information Technology adoption in the Nigeria manufacturing sector from findings and relevant literature.
- ❖ To investigate the factors influencing ERP system adoption within the Nigeria manufacturing sector.
- ❖ To identify the most challenging functional units within the Nigeria Manufacturing Organisations.
- ❖ To investigate the critical success factors for ERP system implementation within the Nigeria manufacturing sector.
- ❖ To propose blockchain technology integration with ERP system to enhance the performance of Nigeria's manufacturing organisations.
- ❖ To contribute to research knowledge for Nigeria's manufacturing organisations planning to adopt advanced technology such as an ERP system.

### 1.6 Research Contribution

This research re-designs the conventional ERP system framework with the integration of Blockchain technology (B-ERP). This immutable data quality is proposed to tackle corruption practices within Nigeria's manufacturing environment towards its development and economy

recovery. Enterprise resource planning has been credited with creating value by integrating activities across the company. Hence, implementing best practices for each business process, standardising processes within organisations, creating data results in less confusion and error and providing real-time access to information.

Other studies have shown that businesses expect so much from an expensive ERP system, such as automatically delivering improved organisational effectiveness and efficiency (Ananiadis, 2005). However, such expectations cannot be met in a corrupt environment. According to the key findings of this research which include ERP complexity, staff training and education, adequate knowledge transfer and corrupt practices at different levels, are among other factors that hinders effective NMO performance. This research contributes to simplifying ERP complexity, improve ERP effectiveness and proffer solutions to the lingering issue of corruption practices that are very pronounced in the developing countries. However, there is little or no enough research study that looks into practically solving corruption problem within the MNOs.

Enterprise resource planning software is a system that connects all of the company's departments into a centralised database. Before the ERP, managing information has been the use of separated systems dedicated to the specific task. Every organisation adopts information system specifically for each functional unit in the organisation such as the Accounting, Human resources, Marketing, Sales and so on. The separate information systems are best referred to as information silos because they do not communicate with each other in real-time (Grant et al., 2010).

The ERP concept has evolved over the years from the elementary "inventory control packages". Change is constant; due to each of the previous packages' shortcomings, another innovative system's evolution emerges. MRPs systems' era became faded gradually due to deficiencies in

managing production facilities and production plans alongside the inventories. Nevertheless, it is essential to improve the incumbent technique, which led to developing a superior and integrated ERP system (Chung & Snyder, 2000).

The way of business practice in every region varies, which affects the implementation of the system. Despite recognising the ERP system in organisations, its adoption and implementation are complicated because many organisations' manner and practice to conduct their businesses are not standard (Markus & Tanis, 2000). The problem facing organisations includes the cost of adoption and the chosen ERP system's effectiveness to suit the organisational functionalities, culture, and organisational structure. All these are very dependent on how well the system's tailoring and configuration process conform to its business process (Al-Mashari et al., 2006).

Research shows that ERP, in general, has indeed contributed immensely to the development and improvement of organisational performance (Riley & Åhlberg, 2004). According to the literatures, a few principal approaches have been highlighted in planning and designing the ERP system's implementation. These include the fit between changes proposed within the system or organisation and the strategy or rather the opportunity (Themistocleous & Irani, 2002). Therefore, the selection of new ERP systems for adoption and implementation to enhance organisational performance, especially when considering developing countries, poses a critical issue (Al-Mashari et al., 2006).

Sometimes ERP systems are highly complex yet significant, due to its influence on an organisation's efficiency and effectiveness. However, its adoption and implementation are complicated; proper knowledge transfer and training is needed to realise its benefit (Remus, 2007). Although several solutions are presented as a plug and play ERP system, rendered in the cloud requiring no complex installations, the system remains expensive. This research contributes to the body of knowledge to support the management in planning organisations

resource effectively. Hence, proper training, practical use and continuous analyses of various issues would provide continuous insight towards optimisation.

### **1.7 Research Methodology Overview**

The studies were carried out by collecting and analysing primary data, alongside secondary data that infer the existing academic literature's findings. After a comprehensive review, of different methods used by another scholar in this area of study such as (Zeng et al., 2017), (Alam & Uddin, 2019), (Costa et al., 2016) and so on, adopted mixed method of data collection in this research. Involving a quantitative and qualitative approach. This approach increases the reliability and validity of the data collected. Data is primarily collected from sources such as professionals with several years of experience with or without ERP in the manufacturing organisation at the managerial level. Also, considered reputable secondary sources journal, the university library, and other sources such as the Manufacturers Association of Nigeria (MAN) restricted databases with specific key words to search for the most suitable material. The research is driven practical approach that defines the nature of the problem and leads to a solution. Thus, to achieve the above research objectives, the following steps were followed as outlined below.

### **1.8 Thesis Outline**

This section provides an outline of the remaining chapters of this thesis. This thesis follows Phillips and Pugh (2000), who described the methodology of four elements:

Background theory introduces the research context (Chapter One), critically analyses the literature, and identifies the research issues (Chapter Two). Chapter Three aims to focus on the focal theory for this thesis and propose a conceptual model. Data theory (Chapter Four and Chapter Five) Chapter Four describes the research methodology adopted. In contrast, Chapter Five implements the research plan by collecting data, analysing the findings generated from

the results obtained from data interpretation. The novel contribution (Chapters Six and Chapter Seven) Chapter Six aims to propose the revised conceptual model based on the empirical findings. Finally, Chapter Seven describes the research summary, main contribution, research limitations, recommendations for the industry managers and practitioners, and further research scope emanating from this thesis.

**Tab. 1.2: Thesis Outline**

	Chapters	
Background	Chapter 1: Research introduction	
Theory	Chapter 2: Literature review	Identification of research issues
Focal Theory	Chapter 3: Developing a conceptual model	
Data Theory	Chapter 4 : Research Methodology	Response to research questions
	Chapter 5: Research Findings and Analysis	
Contribution to Knowledge	Chapter 6: ERP framework re-designed	
	Chapter 7: Validation of the proposed model	
	Chapter 8: Research conclusion	

### ❖ Chapter One: Research Introduction

This chapter introduces an introduction to the main issues and research problem in Nigeria's manufacturing sector and the ERP domain. These issues consider the need to understand ERP adoption and implementation practices and improve Nigeria's Manufacturing sector's decision-making process. It also has provided the main aim and objective of the research as a foundation to this thesis.

## ❖ Chapter Two: Literature Review

This chapter starts to review the literature on IT adoption and implementation practices in Nigeria's Manufacturing sector. It also highlights several IT infrastructure limitations in Nigeria's Manufacturing sector, emphasising the need to improve Nigeria's Manufacturing sector IT infrastructures, analyse ERP literature, and explain the benefits realisation, challenges, and ERP failure. The author then discusses ERP adoption and implementation, ERP adoption and performance factors, and ERP adoption and implementation lifecycle phases. Lastly, justifying the need for a collective and systematic approach for adopting and implementing ERP in Nigeria's manufacturing sector.

## ❖ Chapter Three: Conceptual Model

This chapter proposes: (a) the identification of factors, (b) prioritising the importance of factors that may provide a deeper understanding of such interrelationships within Nigeria's manufacturing sector, (c) the identification of ERP adoption and implementation lifecycle phases and stages, and (d) the mapping of factors on ERP adoption and implementation lifecycle phases and stages. In addition, this chapter proposes a conceptual model for ERP adoption and implementation in Nigeria's manufacturing sector. The proposed model is developed to support management when taking decisions regarding ERP adoption and implementation.

## ❖ Chapter Four: Research Methodology

This chapter aims to prepare a research plan that will eventually lead to the assessment and evaluation of the proposed conceptual model described in Chapter Three. In this chapter also, the author describes the justification for selecting an appropriate research methodology. This chapter describes the research methodology adopted to support in achieving the research work presented in this thesis.

### ❖ Chapter Five: Research Analysis and Findings

This chapter analysed and presented findings that were conducted within the Nigeria Manufacturing Organisations. The results of secondary and primary data collected provide significant findings and discussion of (a) background to case studies, (b) ERP project process, (c) state of ERP, and (d) assessing the research propositions.

### ❖ Chapter Six: ERP framework re-designed

This chapter exemplifies revised ERP adoption and implementation factors and modified ERP adoption and implementation of lifecycle phases and stages based on case studies findings. It will suggest modifications to change the conceptual model for ERP adoption and implementation.

### ❖ Chapter Seven: Validation of the proposed model

In this chapter, a scientific approach is used to validate the proposed B-ERP model.

### ❖ Chapter Eight: Research Conclusion

This chapter outlines the research overview employed in this thesis. It discusses the main contributions of this thesis. Then, this chapter moves onto highlighting the research limitation that requires further attention. Lastly, based on the overall research conducted in this thesis, the author presents some key recommendations.

## 1.9 Conclusion

From the research synopsis presented in this chapter, the author argues that adopting and implementing ERP systems is a massive task for organisations. The decision-makers in Nigeria's Manufacturing sector are thus required to prioritise their technological infrastructure planning and deployment to realise their initiatives fully. Such infrastructure ought to be flexible, scalable, and facilitate interoperability within and across Nigeria's Manufacturing

sector. This chapter discussed the research context and the problem domain, research aim and objectives, and overall structure of this thesis.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

The literature reveals the established findings of other studies related to the research topic. It drives the research concept background, addresses current gap in studies and establishes possible extension areas. This chapter examine the relevant academic literatures on factors surrounding ERP adoption and implementation with regards to Nigeria as a developing country. The first chapter(1) indicates that, the interest of this study is to enhance productivity within the manufacturing sector. Literature evidenced that ERP implementation can be potentially useful in different social cultural environments (Wynn & Rezaeian, 2015).

This literature review chapter is a re-caps of what has already been written, relating to this research topic. Also, this chapter present a clear overview of what was found in the literatures and outlines the missing knowledge(gap). This is achieved in three(3) simple steps.

1. Gathering the relevant literatures: Searching for relevant literatures on factors surrounding ERP adoption and implementation from reliable scholarly data sources such as: Research libraries, Science direct, PubMed, Google scholar and so on.
2. Evaluation and selection: It is impossible to cover every written document about a topic, except a very niche or new topic. Therefore, there is a need for critical selection. This is achieved by evaluating the resources collected, then selecting relevant ones.
3. Identify themes and gaps: The information gathered are chronologically organised. The connections between different documents are noted based on existing themes, trends and patterns, debates and contradictions, influential studies and gaps were identified.

Researchers define ERP as a core information system that integrates the entire business functions in an organisation. Also, ERP system is said to be capable of bringing different information packages into single application within a synergetic environment (Ravasan & Mansouri, 2016). However, research have also noted that ERP implementation attracts a significant level of risk, due to high possibility of implementation failures (Abdelmoniem, 2016; Shao, et al., 2016). In developing countries such as Nigeria, ERP implementation risk is said to be amplified due to limited resources, budget and expertise, as majority of the enterprises are small and medium (Asemi & Jazi, 2010).

Also, findings show that critical success/failure factors, adoption determinants and implementation constraint of Enterprise Information Systems (EIS) in different countries cannot be generalised. This is because the nature of work, available resources, organisational structure, reporting system, decision making process and operational activities may differ from

other countries (Tome Mr, et al., 2014). This chapter seeks to identify existing research on factors surrounding ERP system adoption and implementation. This is done in attempt to answer some of the research questions, tailored towards the aim and objectives of this study. The purpose is to present the reader with a clear understanding of the themes, trends, gaps, debates and contradictions identified. This study focuses on ERP implementation within the Nigeria manufacturing organisations(MNOs) and proposes a re-design suitable in this environment.

This chapter presents a literature review of the related studies, concepts, and frameworks that support this research. The aim of this research was to Investigate how ERP re-design can enhance productivity in Nigeria’s manufacturing sector, to encourage investors and towards general improvement of the country’s economy. The aim was also pursued with the following research questions. 1) What is the extent of advance Information Technology adoption in Nigeria’s manufacturing sector? 2) What are the factors influencing ERP adoption within the Nigeria Manufacturing Organisations? 3) What are the most challenging functional units within the Nigeria Manufacturing Organisations? 4) What are the critical success factors (CSFs) for ERP system implementation within Nigeria manufacturing sector? 5) How can integration of Blockchain technology with ERP system improve the performance of the Nigeria Manufacturing Organisations? 6) Considering the factors influencing ERP adoption within the Nigeria manufacturing organisations, will there be a significant classification of impact on business performance for implementing a Blockchain-ERP system within the Nigeria Manufacturing Organisations.

To thoroughly review the literature, this chapter is split into separate sub-sections such as:

**Tab. 2.1 An overview of the literature review**

Sub-section	Title
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2.1	Introduction
2.2	ERP system
2.3	ERP system adoption and implementation
2.4	Functional units and its related ERP modules in a manufacturing environment
2.5	ERP critical success factors (CSFs) in developing and developed Countries
2.6	Overview of Information Technology (I.T) Adoption in Nigeria
2.7	ERP system adoption in Nigeria Manufacturing Organisations
2.8	Nigeria's Economic Growth and Recovery Plan (EGRP)
2.9	Conclusion

### 2.1.1 Literature Search Approach

The literature search approach involves the use of various channels such as libraries and online sources. This include related journals, books report and other reputable online materials. Database such as the EBSCO Business search premier was very helpful for peer-reviewed journals articles. Other source of resources such as ProQuest Dissertations, ScienceDirect, Research-gate, New Mexico state University, Walden University and Anglia Ruskin University was very well utilized. In gather relevant resources, keyword control search was carried out on Google scholar. Some of the words search are “ERP adoption and implementation”, “Critical success factor for ERP Implementation”, Nigeria manufacturing environment, Manufacturing association of Nigeria, “Industry 4.0 fourth industrial revolution”, “ERP Implementations in Nigeria”, “ERP in developing countries”, “ERP in small and medium organisations”, “Failed ERP implementations” ERP implementation frameworks” ERP Cloud computing” and so on. The controlled search enabled filtered search based on respective area of interest.

**Tab. 2.2 Summary of material sources**

Sources	Number
Books	50
Journal Articles	90
Reports	30

Dissertations	10
Others	15
Total	195

## 2.2 ERP System

The pre-incident of Enterprise resource planning (ERP) is as a result of exponential growth of information and communication technologies, which created a great influence towards continuously improve computer hardware and software systems and this has affected all aspect of computing applications across various sectors especially enterprises (Anglia ruskin, 2015). The business environment in the 21<sup>st</sup> century is said to be getting complex with functional units requiring, different real-time and efficient data flow for management decision making, procurement plan, inventory tracking, accounting and finance, supply chain, human resources and so on.

All these constitutes the needs of a modern-day efficient information system for an effective resource management (A Rashid, 2002). In view of these, the early generation of inventory control package was in 1960s, followed by Material requirement planning (MRP) was said to be in 1970s, which later evolved into Manufacturing Resources Planning (MRP II) in the 1980s, followed by the Enterprise resource planning (ERP) and extended ERP which are recently experienced from the 1990s through to the 21<sup>st</sup> century respectively. Enterprise Resource Planning (ERP) is a breakthrough technology that facilitates the management system by providing different modules to manage entire organisational activities. It is a common database system that manages organizational processes, supporting numerous functions and integrating multiple applications.

There is a massive market for ERP services worldwide with increasing value of around \$10 billion in a space of five years (Van Everdingen, et al., 2000). This massive growth is as a result

of ERP efficiency that led to a competitive advantage for organizations integrating the systems. ERP system acceptability has cut across various sectors administration requirements with merits ranging from convenient data accessibility, process monitoring and easy decision-making process. Furthermore, ERP systems integrates real-time communication among various units, executing various functions in a solitary system. This enables all the end users to interact and use their resources respectively in a single correlated system (Mindgadget, 2019). The table below represents some of the ERP modules available to organisations.

**Tab. 2.3: ERP System Modules (Mindgadget, 2019)**

ERP Modules	Description
Sales & Marketing	Operations and activities involved in promoting, distributing and selling goods or services.
Procurement	Maximise cost, savings for acquiring goods and services, or works from an external source with support of end-to-end logistics processes.
Production	Planning and optimising the manufacturing capacity and material resources.
Distribution	Control warehouse processes and manage movements in the warehouse and respond faster to challenges and changes in supply and demand.
Accounting	Automate financial operations while ensuring regulatory compliance and gaining real-time insight into overall performance.
Human Resources	Maintain a complete employee database and to optimally utilise all employees.
Customer Service	Capture and maintain customer relationships, facilitate the use of customer experiences, and evaluate the feedbacks.
Stakeholders Involvement	Information flow between all business and managing connections between the interested parties.

Enterprise Asset Management	Efficiently and sustainably manage the entire asset lifecycle, improve asset usage and cut cost with powerful analytics.
Business Intelligence	Abundant data-based information for effective decision making.

### 2.2.1 ERP System Definition

Enterprise resource planning system has a shared database system that support organisation's processes by managing various functions within integrated applications (Assma, et al., 2017). According to Klaus, et al., (2000) ERP system is an approach organisations are adopting in planning for the whole process involved entire functional areas in an enterprise. Also, it is defined as an enhancement to organisation's activities such as tracking orders, production/service planning, inventories management, procurement, and client interaction. All these is managed by a multiple module application software which helps an organisation manage its business efficiently (Ellen & Wagner, 2013). (Mabert et.at 2003) explained ERP as organisation's online interactive system that utilises a common database to manages different departments and cross functional processes.

Lastly, ERP system is described by (Zahang and Li, 2006) as an integrated system due to the shared database which allows flawless data flow within multiple modules without interruptions. ERP modules include financial accounting (FA), sales and marketing (S&M), Human resource management (HRM) and Production planning. These tools allow a centralised entry of various business activities in a unified database in an organisation. Hence, multiple entries of the same data are eliminated (Jacobs & Bendoly, 2003). The similarity in the various definitions of ERP system is the integration concept and the unified database, which manages organisation's core activities.

### 2.2.2 ERP System Evolution

The enterprise resource planning concept have been for many generations, as discussed by several researchers to have originated from Material Requirement Planning (MRP) in the 1960s to the 1970s (Jacobs, 2007), which explained that MRP is intended to monitor and control production operations most especially the inventory. The need for more integration between the functional areas of the enterprise led to the move beyond MRP which occurred in the late 1970s and early 1980s since the operations in production is just a single arm of enterprise management, the enterprise financial aspect of the enterprise was managed separately, which led to duplicate, data conflicts and inconsistencies (Jacobs, 2007). The evolution to MRP II (Manufacturing Resource planning) occurred in the 1980s for a more preferred planning of all resources of a manufacturing company to be specific (APICS, 2016). MRP II is said to be efficient for manufacturing planning majorly, it also increased profitability. The concept of customer satisfaction became the most important objective to a business entity, this has a broad scope than planning, it comprises of sales and distribution, human resources and so on (Katuu, 2020)

**Tab. 2.4: ERP Evolution (A Rashid, 2002)**

Time	System	Description
1960s	Inventory Management and Control	Inventory management and control is the combination of information technology and business processes of maintaining the appropriate level of stock in a warehouse. The activities of inventory management include identifying inventory requirements, setting targets, providing replenishment techniques and options, monitoring item usages, reconciling the inventory balances and reporting inventory status.
1970s	Material Requirement	MRP utilizes software applications for scheduling production processes. It generates schedules for the operations and raw

	Planning (MRP)	material purchases based on the production requirements of finished goods, the structure of the production system, the current inventories levels and the lot sizing procedure for each operation.
<b>1980s</b>	Manufacturing Requirements Planning (MRP II)	MRPII utilizes software applications for coordinating manufacturing processes, from product planning, parts purchasing, inventory control to product distribution.
<b>1990s</b>	Enterprise Resource Planning (ERP)	ERP uses multi-module application software for improving the performance of the internal business processes. ERP systems often integrates business activities across functional departments from product planning, parts purchasing, inventory control, product distribution, fulfilment, to order tracking. ERP software systems may include application modules for supporting marketing, finance, accounting, and human resources.
<b>2000s</b>	Internet enabled ERP systems	ERP trends continues with capabilities for digitization, ERP options with cloud computing, internet of things, big data, mobile and analytics.
<b>Future trend</b>	Sustainable/extended ERP	Integrating sustainable operations include ERP re-design to suite an environment.

### 2.2.3 ERP System Benefits

Enterprise resource planning (ERP) system adoption is attributed to huge responsibility on the management. On one hand a business manager wants to be responsible for innovative growth and development but on the other hand, nobody wants to pull the trigger on a failed project. Hence, selecting the right technology for a business needs can be quite challenging. Therefore, it is important to highlight huge potentials of ERP system and its benefits for business growth.

A few of these are discussed below:

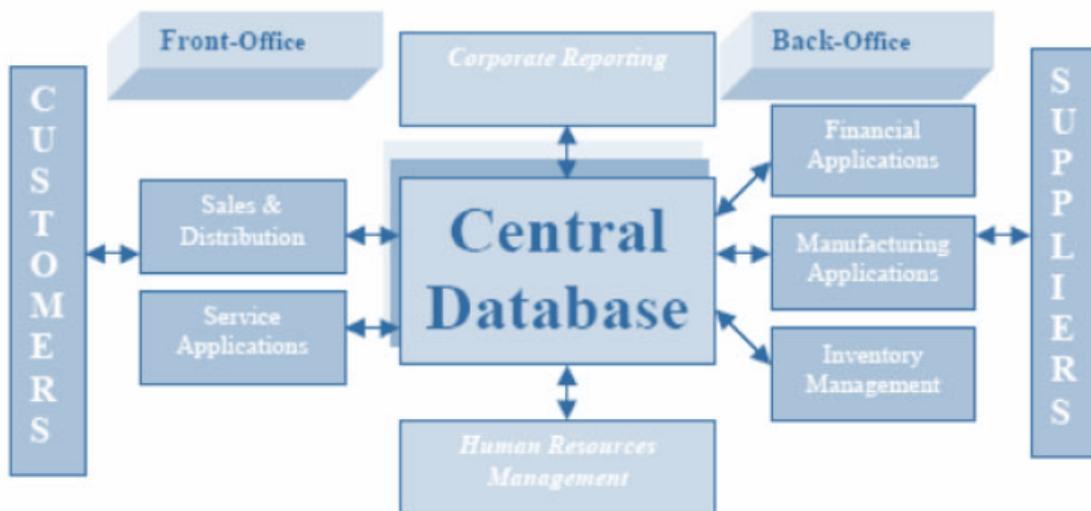
- ❖ **Enhanced Technology:** ERP system allows different departments across the organisation to share an integrated database with an enabled real-time activity. It is an improved technology that enhances the key business processes within and beyond the organisation's limitation. ERP enhancements create organisational continued improvement by enabling the business to keep up with speed of more operational demand, huge efficiency of business process by eliminating intensive manual processes across various departments.
- ❖ **Overall Visibility:** This is a very essential benefit of ERP system because its system creates total access to the overall business process by making entire data from every department easily accessible to the management depending on the level of authorisation. For instance, it allows a real-time monitoring of inventory level daily, which can even include future batches both in transit and yet to be received. This little example shows broad visibility on inventory which enables control of working capital more precisely. In addition, complete visibility allows more coherent workflows within various departments making inter-departmental processes to be tracked efficiently.
- ❖ **Advanced planning and reporting:** Considering the impact of overall visibility as an enabler for advance planning and reporting. comprehensive insight is a cogent merit of ERP. The implementation of an ERP system implies that the entire organisation now uses a unified reporting system. As a result, ERP system can produce reports and analytics at any time required without the hassle of multiple spreadsheets. Financial report is one of the important to any business, reflecting information such as income, expenditure and cashflow statements allowing proper planning in advance. In addition, many modern ERP with continuous improvement now integrates business intelligence for deeper level of analytical strength, provided as a single package on cloud ERP. These boosts corporate planning by identifying problematic areas that requires improvement.

- ❖ **Customer Service Efficiency:** The clients of the business also benefit from ERP system, even when they are not aware of it. This is because customers information is centralized, which enables the customer service representative to focus on maintain and building customer relationships instead of focusing on spreadsheets. The ultimate priority of any business should be customer retention and new acquisitions. The services of ERP make better customer interaction with targeted market possible by the means of end-to-end tracking and insight offered. In addition, many modern ERP with continuous improvement now integrates eCommerce integration, that means the business can handle a web-based order processing and tailored/person centred interactions.
  
- ❖ **Business Process Standardization:** Most Enterprise Resource Planning system are developed in accordance with industry best practices. These practices have already stood the test of time; therefore, they bring major benefits to businesses of various sizes. This attribute enables standardization of businesses also enhancing productivity and efficiency. These standard business process delivers a consistent result that makes continual improvement in business operations possible and because many of the process are automated, it greatly reduces cost incurred and errors made. This eventually results in more profit, improved synergy between departments and less friction.

#### 2.2.4 ERP System Concept and Architecture

There are various write ups on the concept and architecture of ERP software but according to its definition it is said to support business processes by a broad set application and integrating the core functional areas of the organisation which include finance, human resources, production/service and sales. Recently some articles classified Customer relationship management (CRM), and supply chain management (SCM) into ERP as a core functional aspect of an organisation (Shi, 2012). Figure 2.1 below represents the illustration of ERP concept. This display the back-office perception, how ERP system coordinates the enterprise

operation processes such as manufacturing, financial, inventories and so on, this aspect relates closely with the suppliers. The front-office is the direct interaction with customers which is also managed with ERP such as sales, distribution, services and so on. The cooperate reporting and the human resources are managed in both cases throughout. The client/server, application module and the database are the key components of ERP system. All these is represented in the figure below and explained.



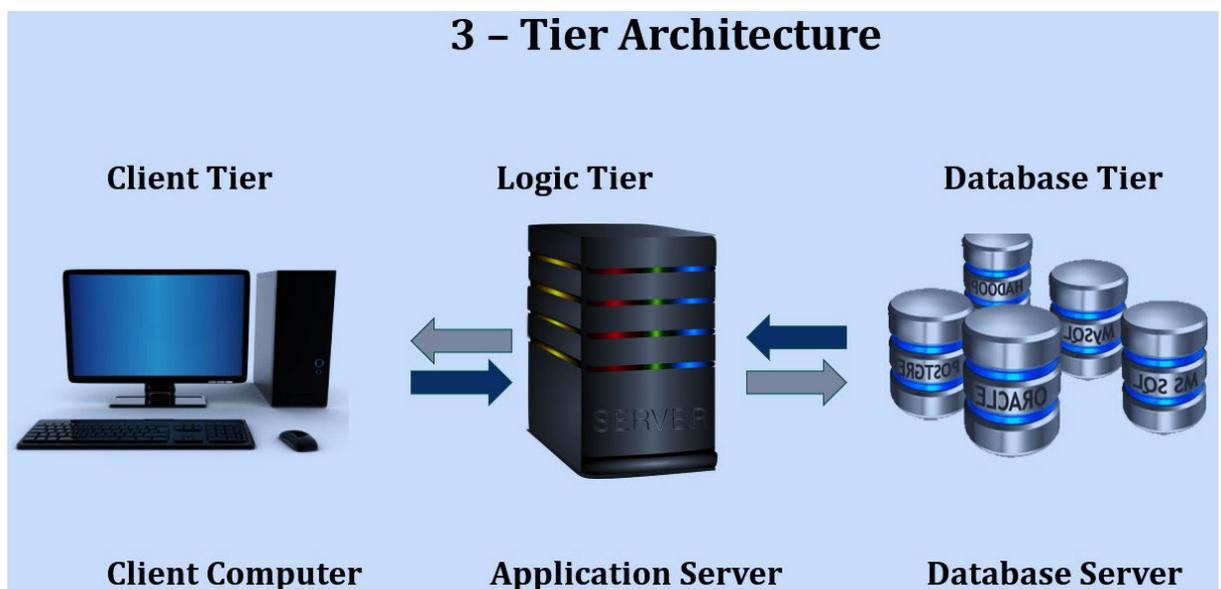
*Fig. 2.1: ERP systems concept (Shi, 2012)*

❖ **ERP Architecture:** The architecture relates the relationship between the three components Client/server, Database and the application module (Yen & Chou, 2002), this model is the common logical model of ERP functions. The diagram below explains how the clients initially communicates with application server, which creates a second communication to the database server.

1. **Client/Presentation Layer:** For system functions or the data entry accessing with the graphical user interface. The presentation layer is known to request for resources from the server, therefore a centralized server may provide resources to several users.
2. **Logic/Application Layer:** ERP has different kind of application modules provided by the vendors; these are integrated software packages for various unit in the

enterprise. The users of these modules in various functional unit is required to comply with the procedures as described by the application module. Therefore, application logics are processed here by the application server.

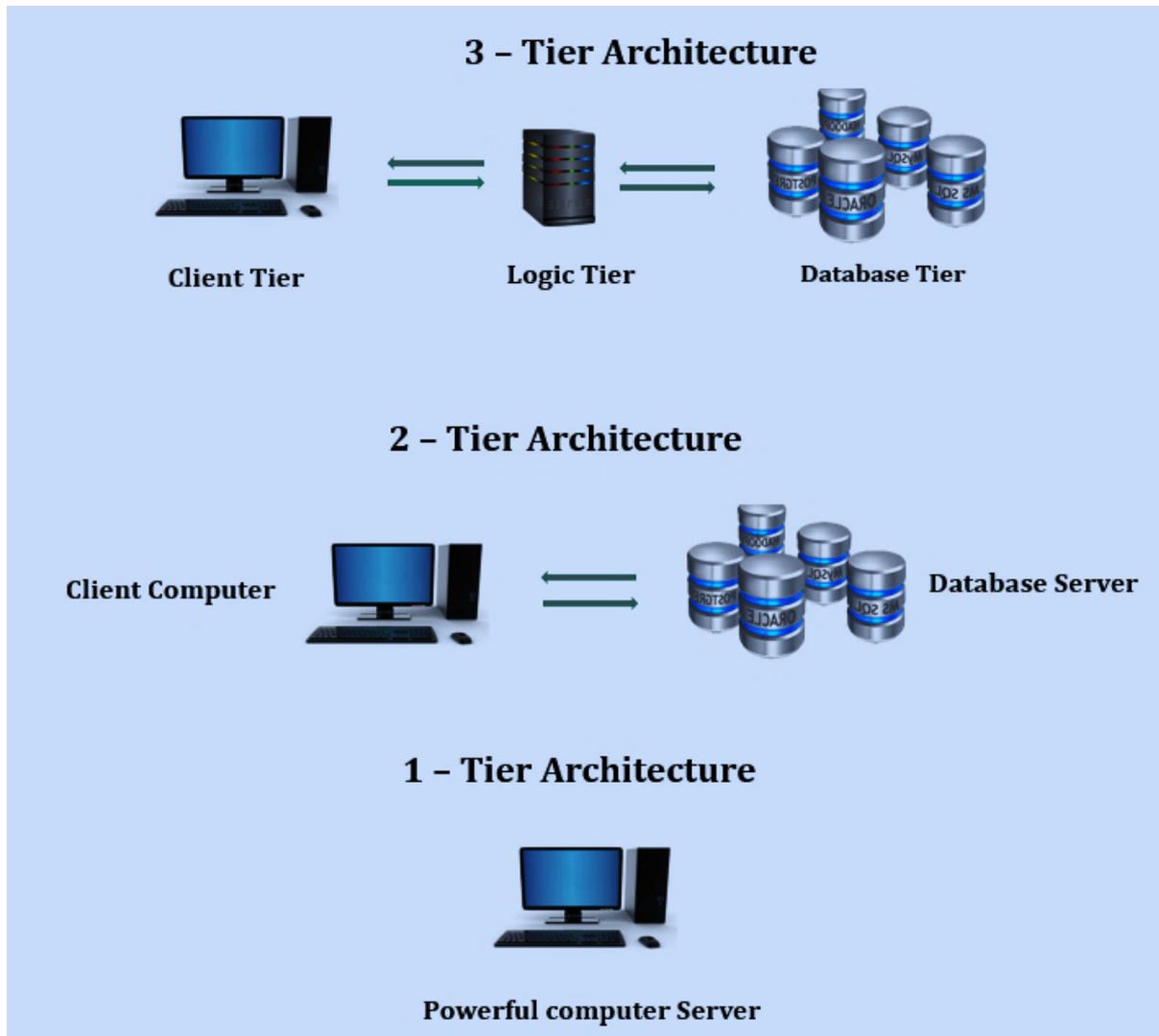
3. **Database Layer**: The database interacts with basically all applications in the entire system, hence there are no severances in data provided and data integrity is certain. This is a storage system that stores and manage all operational and transactional data including set of data that describes information about other data.



*Fig. 2.2: Three-Tier ERP systems architecture*

The architecture holds a major role in ERP scalability, durability and most especial the success of the system adoption (Assma, et al., 2017). Technology advancement fast track the advancement of the system architecture. There are few types of ERP system architecture with different strength and weakness (Gunawan & Surendro, 2014). The Three-Tier architecture is an upgrade of the Two-Tier architecture which is also known as the client-server architecture. A representation of the tier's comparison is indicated in the fig 2.3 below. The three-tier architecture is composed of three layers namely Presentation, Application, and the database layer. There is no direct communication between the client and the database, an application layer is now introduced to carry out the business logic. Hence, the presentation layer's

operation is to browse data and provide a user-friendly interface and this reduce the necessity for the user to have powerful computer. Lastly, the application layer retrieves and transfer to the database servers and it is also where the logic and the business rules are implemented.



*Fig. 2.3: Tiers Architecture (Assma, et al., 2017)*

❖ **Web Architecture:** The architecture allows access to the ERP system from anywhere and anytime due to adoption of internet technology, new functionalities such as automation was introduced. Unlike the Client/Server system which was a small software programme, needed to be installed, maintained and updated on each desktop, moreover, this task is to be carried out on all the desktops located at various node of a widespread area network, which gets very difficult. The goal of web enabled ERP is to allow remote users to gain access to the

ERP system as represented in the diagram below. The application and database layer are included in web architecture just the same as the three-tier architecture. Hence, in this architecture web presentation layer presentation layer is split into two parts namely, web services and web browser (Assma, et al., 2017).

They both support device mobility via the internet. This type of architecture way not needed initially for some organisations but with consistent growth, web enabled ERP becomes a solution for scalability and need for a remote access. The advancement of this architecture was to extend other layers in the system to the web to enable increase mobility, allow supplier and vendor access and collaboration via secured internet web (Assma, et al., 2017). This means the ERP system needs to be redesigned and made compliant of standard such as the Java 2 Enterprise Edition (J2EE). Although, achieving this can be time consuming because the traditional ERP systems are not flexible, complex and they are built on proprietary platforms and slow. But the emerging technologies and architectures such as WEB 2.0, Service Oriented Architecture (SOA), Software as a service (SaaS) will be able to adapt changes and improvements (Assma, et al., 2017).

❖ **Service-Oriented Architecture (SOA):** The service-oriented architecture (SOA) connects different applications and various services and facilitating sharing of data in a single system. This architecture is based on the use of services, due to growth of organisations, there is an increase in the number of services it is required to deliver (Assma, et al., 2017). Hence, a lone system for each service is lunched. The service-oriented architecture (SOA) enables easy ERP customization and modification in an enterprise. Because the services are based on different layer, this enables changes to be made to the ERP system without source code and logic alteration, make the software adjustable to changing business needs. Additionally, SOA encourages the re-use of existing services, not to mention the hard,

expensive, and intensive to develop communication across the different systems if regular interfaces are used. Hence, the concept to standardize messages with IT landscape of an organization and extensible mark-up language (XML) is a means to standardize message that is communicated between systems (Assma, et al., 2017). XML can be described as a way of relating information or data shed electronically and disallows sharing of information in a consistent pattern to support the concept of SOA. The XML concept makes service-oriented architecture to become credible (Assma, et al., 2017).

❖ **Cloud Computing Architecture:** Cloud computing has become increasingly accepted, although the willingness of a well-established organisation trusting a third-party to store and manage all its information remains a matter of debate. The innovations embedded in new technologies require new thoughts and cloud computing is an innovative thinking. The fast pace of internet growth and increased reliability especially in the developed countries, made this technology to rise and making its way into the reputable technological ground. The diagram below displays an elementary concept of the cloud computing architecture. As it is already known that each architecture has its peculiar pros and cons, it can be sometimes complicated to choose the most appropriate architecture for an organisation. One of the first considerations is that an organisation must specify its budget and limits considering employee's responsibility to operate and maintain the adopted ERP system. These criteria can be a determinant of the architecture type to be adopted in an organisation.

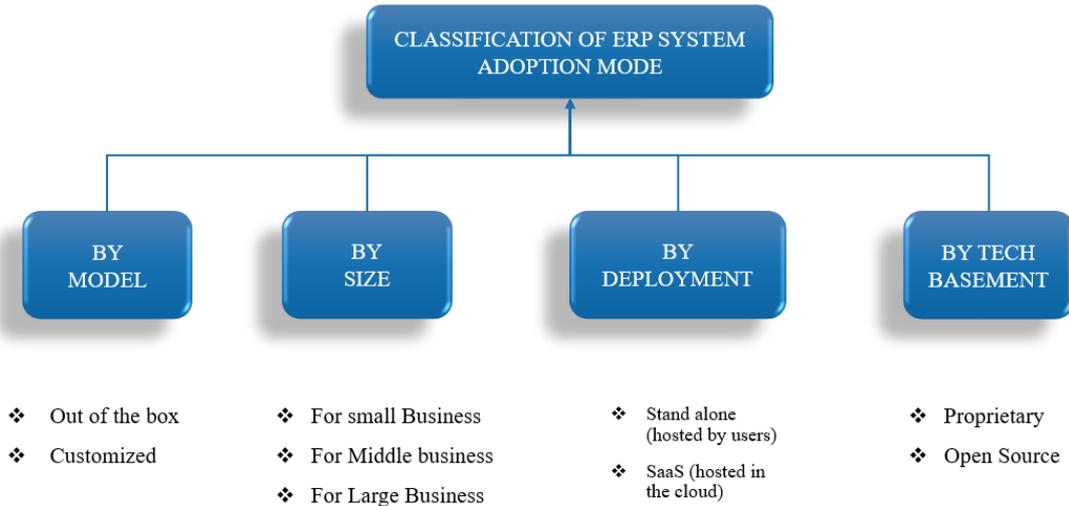
The other architectures can be scalable, reliable, and flexible as well, but they can also be costlier and more complex. However, currently a small and medium sized enterprise SME should be able to afford a deployed cloud architecture. The security of other architectures can also be of question, the information data may give a security bug for the hackers. This is also applicable to cloud computing architecture in a different way because its security is depending on a third-party. Infact this sole reason is what cause of organizations with more sensitive data

to disregard the cloud architecture. Comparing with the SOA, any organization that is looking out for an expandable and independent system, the SOA appears to be the better choice because it is more secured, complex, and advanced (Assma, et al., 2017).

### **2.2.5 ERP Mode and Deployment Methods**

The contemporary ERP system solutions available in the market currently feature a modular scheme. That means, programs and modules are in form of building kits with independent bricks which a client or the developers can add or remove easily without hassle (Diceus, 2019). The regular ERP system modules such as Supply Chain, Production/Inventory, Human resources, Customer Service Relationship, Accounting and so on. The core concept remains that ERP applications connects various departments in a single system, and it enables trained personnel to automate the regular activities involved in a process and eliminating human error. The modern ERP system falls under four major classifications, which allows a business with clear needs to choose the relevant features in a way that cuts cost (Diceus, 2019). The classifications include:

- ❖ By model: This can be a vendor's readily available model to be deployed or custom
- ❖ By Size: Relatively for small, middle, and large businesses.
- ❖ By Deployment: This can be referred to as a stand-alone (hosted on-premise) or SaaS (hosted in the cloud)
- ❖ By technological Basement: The proprietary and the open source



**Fig 2.4: Classification of ERP systems adoption mode (Diceus, 2019)**

The choice within the classifications depends on the needs of the organisation adopting ERP system. The choice can also be affected by the cost of purchase and it can be regular monthly fees or the one-time payment. According to Quora and Capterra the cost monthly can range from \$10 up to \$200 unlike the one-time purchase which can range from several thousands to millions in dollars. An example of the monthly rental is the cloud ERP system which will be elaborated in the next section.

### **2.3 ERP system adoption and implementation**

Enterprise resource planning system adoption has been attributed to organisations search to improve their business efficiency and profitability. Organisations seeks improvement in various aspect of their business such as inventory management and finance. ERP system adoption is said to help consolidate the disjointed business activities within an organisation, including suppliers and customers (Alam & Uddin, 2019). Enterprise resource planning system adoption supports better decision-making through access to wider view of the entire activities in real-time by integrated business process (Costa, et al., 2016). Implementation is based on

organisation's strategic expectations, targeted benefits, and analysis of capital investment in the pre-implementation stage.

Hence, organisations in developing countries needs to be thoughtful about the designing and planning of ERP system selection (Asemi & Jazi, 2010). Because the successful implementation of ERP system will enhance the expected benefits for organisation and re-arrange the organisational structure. Also, ERP system subsequently influences the operational effectiveness, huge improvement in technological performance, and business efficiency (Khamis & Rozan, 2015). There are little research on enterprise resource planning (ERP) in Nigeria until recent decade when the need to adopt advance Information Technology arose in many organisations in other to meet up with modern day customer demand and make competitive edge (Irefin, et al., 2012).

Several organisations of all sectors are currently making good use of information and communication technology (IT) around the world, it is not only for the purpose of cutting costs and enhancing efficiency, but also for providing improved customer service relationships (Irefin, et al., 2012). Also, in developed countries we have seen the adoption of IT by small and medium enterprise (SME) which has greatly transformed the mode of operation, unfortunately this is not yet the case in Nigeria very few adoptions of modern IT such as Enterprise resource planning is only seen in Multi-national large organisations. Research has shown that ERP benefits are realised from a successful implementation of the system's modules.

The integration of the organisational processes considering the internal and external organisational factors, affects the connection between each unit of the organisation. In other words, this can in turn influence the profits, create competitive edge, panoptic empowerment and boost individual performance in an organisation. A panoptic empowerment is as a result

seeing the overall business process at one view. ERP systems are inclusive software that incorporates the entire business process ranging from the production/manufacturing, supply chain/logistics, sales & marketing, accounting & finance, human resources and customer service activities (Doom, et al., 2010). According to Chang, et al., (2008) organisations is required to understand the nitty-gritty of system adoption from the perspective of the users to prepare them for new challenges that may come up from its implementation.

### 2.3.1 Adoption and implemetaion Stages

There is a widely and most identified enterprise resource planning (ERP) system implementation model in the literature, especially by literatures with models comprising five stages. The five stages include ERP organisational readiness, ERP selection process, ERP implementation, ERP final preparation and ERP live-run. Organisational readiness is widely discussed in research alongside with the final preparation stage which is strongly recommended to make sure that the implemented infrastructure is tested and proper training for the users is completed before the ERP live run (Hongyi, et al., 2015).

- ❖ **Stage 1: ERP Organisational readiness:** The assessment of the readiness to adopt ERP in an organisation in terms of resources and management, is important before selecting an ERP solution. The proper analysis of organisational readiness is attributed to the critical success factors and the key performance indications. This will allow the enterprise to identify the various performance gaps that might obstruct the ERP implementation.
- ❖ **Stage 2: ERP Selection:** This is the stage where the company starts the process of choosing an appropriate and suitable ERP package and implementation vendor. There is a need to set up a committee, their duty is to identify all the business requirements in the entire enterprise, its customers, and partners. The information such as system functionality, product roadmaps, reference sites, ERP vendors, local support capabilities, all these are

identified and screened. The committee will come up with a short list of suitable ERP packages and possible vendors. An intense evaluation will be carried out to select the most suitable package and vendor before proceeding to the negotiation where the contractual terms are stated out, where also the final recommendation is made which is affirmed by the board of directors.

- ❖ **Stage 3: ERP Implementation:** This stage covers the project scope of installation. This stage involves selection of the project team members, the project standards are set, and procedures are put in place. The customer requirements are incorporated into the project product description. The business process is redesigned to meet the implementation requirements. In addition, system configuration, testing, user training and installation are done completely.
- ❖ **Stage 4 ERP Final preparation:** ERP final implementation stage is important to make sure the system, process, management, and the users are well groomed and prepared for the live-run. According to Gulledge & Simon, (2005) the final preparation task includes the following: Integration and stress test to verify hardware capabilities, Data recovery test in case of a disastrous unexpected incidents to determine the recoverability and the system availability, also the user acceptance test to evaluate the users acceptance of system functionalities. The need for a cutover plan to move to the production/live-run environment with users training completed.
- ❖ **Stage 5 ERP Live-run:** This is the performance stage where customer feedback is collated as performance assessment and implementation monitoring means. It is important to assess the performance every six months during an ERP live-run. To support a continuous improvement of the system performance, it may also be rectifying some issues that require repair as a result of use. The monitor is put in place most especially because of the continuous improvement concept. There are two other possible activities when conducting

such periodic review, this includes the system upgrade that allows additional capabilities to obtain preferable benefits, and the system retirement. In this situation the old ERP package might need to be replaced with a more suitable, recent advanced package to meet the organisational needs of that time and era.

### **2.3.2 Proprietary or closed source ERP software Adoption**

Proprietary or closed source software is the direct opposite of “Open source software (OSS)”. This type of ERP adoption involves a conventional license, either through a one-time license or by subscription pricing. The source code for a “Closed source ERP” is not accessible to users or developers to view or edit. However, many of the leading ERP solutions provided a closed source ERP system. The use of closed source ERP software entails much lower risk because it is the responsibility of the vendor to ensure consistent functionality and uptime of the system (USA, 2018). The software improvement, maintenance, update, data protection and security of the system is also included in the vendor’s job description.

In conclusion, closed sourced ERP systems are better in many situations to mitigate downtime risk and to ensure function reliability. However, a small manufacturing organisation that has less functional units with very simple processes and efficient IT developmental staff may consider the use of open source ERP software (USA, 2018). The next subsection explains explicitly “Open source ERP software”, its adoption and relevant examples.

### **2.3.3 Open source ERP software Adoption**

The big names in the space of enterprise resource planning software provision are SAP, Oracle, and Microsoft, which are often expensive. There are a few alternatives to flexible, cost-efficient, and feature-rich open source systems. The open source software is defined as easily available software that grants the rights to read, use, modify and share source code for the particular software under the same conditions, in a non-discriminating manner (Jaeger &

Metzger, 2002) this was discussed further in the proceeding conference on information science, technology and management (Rose, et al., 2006). Open system software (OSS) is a software that is freely available with a granted freedom/right to read, use, modify and share the source code of the software without any restrictions of any type, therefore OSS applications are said to proffer multiple areas of potential technological advantage some of the advantages include; the high level security, stability, flexibility, economically viable with regular upgrades (Ellis & Van Belle, 2009).

The open source software generates a massive benefits across different sectors, creating internal knowledge base, skills sets and empowerment that reduces reliance on foreign software and services, the cost of purchase and maintenance is at a reduced rate resulting in independence and IT job opportunity (Miscione & Johnston, 2010). This could help in SME's especially in the developing countries. Also the adoption of proprietary and open source software under different licensing systems, this is referred to as a hybrid business model, this is seen in research of evolution of the industry. According to Bonaccorsi, et al., (2006), a survey of 146 Italian software firms indicates that firms have adjusted to an environment controlled by mandatory standards by going hybrid. The studies on OSS have shown that there is a huge increase towards its adaptation in the private and public sectors, and in different parts of the world (Ellis & Van Belle, 2009).

The South Africa government adapted OSS in 2001 and by the year 2003 South African government developed a policy document which enthused all government department to fully support the adoption of Open source software, which was the first among African country (Miscione & Johnston, 2010). According to Rubens (2015), open source software (OSS-ERP) represents a little portion of the massive ERP market. The market is dominated by a handful of commercial products presented by the popularly known enterprise software vendors such as

SAP, Oracle, Microsoft and Sage. There are plenty of open source ERP (OSS-ERP) projects, but their collective market share is of little percentage, perhaps as little as 1 or 2 percent. In spite of the many known advantages of open source software (OSS), the fact is that it is usually free to download making it cost effective and can also be customized as much as needed, that is easier to tune it to suite the customer's requirements.

The number one factor that accounts for the small ERP market share of open source is that most of the open source ERP projects lack marketing, while big vendors like Oracle and SAP spend billions of dollars on their sales and marketing. The implementation of ERP systems is mission-critical and selecting a good one is not an easy task. That means most customers need assistance with the selection process. But since most open source ERP vendors spends little or no money to boost their sales and marketing strength, it is hard for them to get on the customers shortlist because many are not aware of their existence. Hence, they are not eventually selected, the problem of expertise is also a main concern.

Open source projects records substantial level of success in areas where the developers are developing for other developers, also very little of the open source developers has the knowledge of ERP expertise in other words when they are building IT tools and infrastructure products like operating systems and Web servers to know precisely what the businesses need and right level of customization. According to Rubens (2015) who suggested a way for open source software (OSS-ERP) to gain recognition is that open source ERP projects should commercialize themselves, they need to create an open source core, and then build proprietary extensions to the core code in other to make a commercial offering that will no longer be an open source. He proposed that this will make some of the free ERP offerings while powerful are nowhere near as complete as the commercial products that are built on top of them.

In the 1990s, a typical organisation in the United State processes a purchase order for at least fifteen to twenty minutes before completion and delivery it to the customer, but in this era any enterprise working at that pace will not be able to survive the competitive business environment of today (Léger, et al., 2011). The supply chain of nowadays now operates based on instant real time updated information because the value of data received is quantified by speed, accuracy, accessibility, and its relevance. The always changing business environment leads to the evolving customer demand, pressure to accelerate business process integration and also the requirement to create more collaborative relationship within the major suppliers, business partners is pushing organisation towards adoption a reliable technology such as enterprise resource planning solution. There are few examples of open source software ERP system such as.

1) **ERP5 system**: This system is a very good example of open source software. The design of ERP software involves putting together the information needed to support an enterprise management, therefore the modelling goes deep down to enterprise modelling then to code generation. The ERP5 tends to cover different level of abstractions, taking into consideration the standards and common practices as well as platform issues (De Carvalho & De Campos, 2006). ERP5 is a free open source ERP (FOS-ERP) offering high technology solution which is based on open source “Zope platform” and written in the Python scripting language, this platform offers an object database (ZODB), a workflow engine (DC Workflow).

A content management framework (CMF) and rapid GUI scripting based on XML (ZPT- Zope page template). ERP5 integrates data synchronization among different object databases, through the implementation of the SyncML XML based protocol, and an object to relational mapping scheme, this store indexing attributes of each object metamodels and glossaries which are collectively called generic enterprise modelling concept (GEMC). (Smets-Solanes & de

Carvalho, 2003). ERP5 is like other ERP systems that uses components as the basis for the system.

There are several features that the ERP5 possesses (Smets-Solanes & de Carvalho, 2003). It is multilingual and deals with various types of currency, it is also compactible with many users and companies, incorporating the unified model of business flow. It also uses the concepts of variation, meta-planning and synchronizes information. On the technological aspect ERP5 offers a recent mapping technology for relational database management system (DBMS) integration, this is a type of new active-message technology for interaction and modelling with a new synchronization technology for electronic data interchange.

**2) Compiere:** According to Serrano & Sarriegi, (2006), the compiere is the best known Open source software Enterprise resource planning (OSS ERP) with over a million downloads since 2001. Since ERP is not simply a click and install application, the user needs to install a relational database management system (RDBMS) along with an application server. The adoption of compiere is widely used in many companies, but the specific number could not be established due to the nature of open source. Compiere has a java set of program component to create graphical user interface (GUI) this application works with a JBoss server; hence it is referred to as a desktop application with a rich interface.

Compiere has very valuable features, one of which is the data dictionary which stores all the information about the user interface, this allows building of windows and tabs that are like each other without incorporating the window and tab definition in the code. There are two basic key concepts in compiere data dictionary which are namely Tables and windows. The table defines the table and their columns in the application, which is usually done by importing the structure form the RDBMS, while the windows define a form's features with the tabs that constitute each and every window which include their hierarchical structure. Thus, each tab is related to the

table columns. See the table below which relates an example of three tabs: Order, Order Line, and Order Tax, hence the tab labels size shows the hierarchy that is an Order covers Order Line and some Order Taxes. This figure indicates that the Order tab is active, and its fields are showing.

### **2.3.4 On-Premise ERP system Implementation**

On-premise ERP system implementation can be referred to as ERP solutions self hosted by an organisation in-house. This solution is often close-sourced, that are acquired via a license model. The host organisation implementing the solution, acquires the software, hardware and licence required to run the ERP system. The software is then loaded onto sophisticated servers and computers. The same organisation manage and controls the components of the infrastructure and the contents on the platforms. Furthermore, all the cost of server maintenance, software updates and memory space including disaster recovery are sole responsibility of the organisation (Duan, et al., 2013). However, ERP implementation is said to be very expensive to host on-premise. Therefore, it can be rendered as a service through a direct network connection that may or may not run via internet. Also, it can be rendered as a “cloud service”. This means that the solution is offered as a service to an individual or an organization by a provider that hosts the physical servers running that service somewhere else (Allart, 2014).

### **2.3.5 Cloud-based ERP system Implementation**

The cloud computing concept is an emerging paradigm, it has really changed the manner which organisations manage software (Khamis & Rozan, 2015). It has lately become a buzzword due to the fast changing global business system in enterprises, which requires a smart solution leading to alterative process of implementing ERP via cloud computing (Fathima, 2012). Cloud computing can be defined as the provision of computing resources as a service rather than as a product (Kuada, et al., 2013). Cloud computing is an innovation that allows resources to be

shared, this applies to the cost as well making the cost of adoption cheaper. Cloud computing reformed how information systems are adopted and utilised. In the past decade, many organisations have started to adopt cloud-based ERP system solutions. The cost of adoption is lower in comparison to the conventional traditional ERP.

The cost of cloud ERP Implementation is within the range of 30% to 50% lower in comparison to implementing on site (Berman, et al., 2012) The providers of this facility whether the software, hardware, platform, or the storage deliver their services via the internet, the usage attracts payment as you go, which changes monthly based on your usage of this facility. This innovation that brought about the ERP vendors to develop a new system of ERP which is referred to cloud ERP posed an opportunity for organisations to upgrade and scale up their operations for competitive preferences, due to cloud computing scalability, high performance which offers organisations to upgrade (Khamis & Rozan, 2015). Cloud computing can be categorized into the public cloud, private cloud and hybrid cloud.

- i) Public cloud computing:** This is the type of cloud service made available to public to use and share, this is owned by the organisation selling the cloud service.
- ii) Private cloud computing:** This type of cloud infrastructure is operated separately for a specific organisation. The management aspect of this service can be by a third party or the organisation itself, either off or on premise.
- iii) Hybrid cloud computing:** This simply means the composition of various clouds such as private, community and public, two or more of them bound together by standardized technology which enables data and application portability. Also the categories of provision of cloud service which includes: Software as a service (SAAS), Platform as a service (PAAS) and infrastructure as a service (IAAS) (Fathima, 2012).

- iv) Software as a service (SaaS):** SaaS first appearance was in late 1990s when discussions about turning software into service emerged, it can be referred to as software on demand, and fast became a model for ERP. It is gradually leading to abolishment of the need to install and run the application on customer's computers and it also simplifies maintenance and support, the customer will rent service from the provider, therefore the customer will be licensed the application by subscription. This is especially the case of "cloud ERP" system. It is allowing all users share the same instances of application. The benefits of SaaS make it very acceptable, such as there is no need to deploy servers or purchase full copies of the software reducing the capital expenditure substantially, also they ease of deployment and maintenance of SaaS is also an important factor to the users. For the vendors, the upgrading timing can be controlled centrally, it also encourages reusability.
- v) Platform as a service (PaaS) :** This is an integrated development environment which also includes security, backup and recovery, application hosting and scalable architecture (Stanoevska-Slabeva & and Wozniak, 2010). This includes the application delivery platform which is hosted by the service provider to support the development and delivery of end-user application. Hence the consumer does not manage or control the cloud infrastructures such as the network, servers, operating systems or storage, the consumer only has control over the provided or deployed application and sometimes the application hosting environment configuration. Ivo Stankov indicated that PaaS allows vendors and software developers to focus on the quality of their product by removing the need to deal with problems and uncertainty of delivery options.
- vi) Infrastructure as a service (IaaS) :** This concept includes virtualized computers with guaranteed processing power along with a reserved bandwidth for storage and internet access. Rather than purchasing servers, software, data centre space or network

equipment, clients instead buy those resources as a fully outsourced service. The typical infrastructure resources include CPU, memory, network interface card, disk and so on, all these are collectively and packaged by virtualization technologies. These technologies resolve the compatibility issues because applications and operating systems supposed to hide hardware from customers. There is huge hype attached to cloud computing, however among the various platforms of cloud computing SaaS is said to have been receiving more focus especially the ERP SaaS (Lechesa, et al., 2012). Software as a service SaaS is described as a business model that allows vendors to play the software infrastructural management role and deploy it to their customers as a service over the internet. The SaaS architecture is designed to accommodate multiple tenants/users based with SaaS application vendors to own and maintain it but it is contrary to the similar Application service provider ASP model (Singh, 2007).

The structure of ASP also consists of deploying, hosting and managing access to applications to multiple parties from a centralised managing facility, these applications are delivered over networks on a subscription basis, this model also speeds up implementation, minimizes expense and risk overcoming the protracted shortage of qualified technical personnel staffs for the user company. There with ASP organisations can deploy enterprise applications with less investment in software, deployment time and IT personnel, but the issue with ASP is that its implementation are specific to industry, region, products and so on, hence ERP SaaS solves the problem of specification and allow more generalisation through customisation and integration, SaaS also provides better value creation through resource sharing, standardising processes and centralisation of data.

The ERP market leader SAP announcing SAP by design, this is their new SaaS solution. Salesforce have recorded success with the CRM systems using SaaS as a new approach to

deliver their software. Technology has involved into cloud computing; SaaS continues to fascinate interest across a gross spectrum of stakeholders. The interest of the vendors and the user's alike benefits from adoption of SaaS is protected. On the hand of the vendors, SaaS has a reduced cost of maintenance and upgrading of the system also it boosts their competitive advantage over software vendors for providing faster upgrades and patches and on the other hand of the customer/Clients SaaS application allows a software implementation project to be done on a pay-as-you go basis, due to the need of the business respectively, saving the upfront cost.

Hence, SaaS encourage focus on the core business areas without less or not too many concerns on information technology matters. The implementation is also short compared to other installed applications (Lechesa, et al., 2012). Many Organisations have always been on a look out for ways to maximize profit, even if they need to adopt new technologies to achieve their desired objectives, one of this is the alternative ways to implement ERP system. The software as a service (SaaS) model has shown as a visible alternative to implementing Enterprise Resource Planning systems. The ERP SaaS has been implemented in Europe, North America and Asia Pacific Countries with a huge success record. Although the rate of ERP SaaS adoption in Africa has been relatively very slow compared to other continents, this is related to various issues such as security, customisation to integration and even cost has been identified to be an issue in Africa (Lechesa, et al., 2012).

#### ❖ **Benefits of cloud-based ERP System**

- i) **Cost reduction:** ERP systems deployed in the cloud are said to be more suitable for different categories of organisations, especially companies with many sites and various geographical locations (Durkee, 2010). However, larger organisations using ERP could

afford an on-site ERP implementation. Therefore, they were reluctant to migrate to cloud solutions due to several considerations such as data security and complexity in the implementation (Khamis & Rozan, 2015). On the other hand, SME companies sees this as a cheaper opportunity to experiment with the attractive cloud solution. According to Rabay, et al., (2013) one of the most crucial advantage of cloud-based ERP systems over the normal ERP systems implemented on site in an organisation. Cloud computing environment enhances cost saving due shared facility resulting in lower cost.

Furthermore, the cloud ERP environment allows SMEs to benefit great features like the large organisations. Also, cloud computing provides SMEs with wide range of new options for assessing the ERP infrastructure. According to Berman, et al., (2012), vendors continues to deploy Cloud-based ERP because they quickly realised the importance of cost reduction which was one of the main reasons for the growing popularity of Enterprise resource planning among manufacturing companies. Research has also shown that organisations aiming to maximize profit while reducing cost are considering adopting cloud ERP solution. This is apparent because cloud service providers are responsible for deploying, maintaining, managing, and updating the infrastructures.

- ii) **Scalability**: Researcher identifies the high level of scalability in cloud computing environment, which enables organization to scale up or down their services respectively based their need. The cloud at the same time accommodates multiple distribution of services among various customers (Onyegbula, et al., 2011).
- iii) **Reduced time to market**: Cloud-based ERP enhances the business agility, enabling manufacturing organisations to quickly adjust their processes, services, and products according to the rapidly fluctuating demands of the market. This facilitates

organization's products to the market on time. Also, cloud-based ERP allows businesses to optimise resources by reducing the cost of managing infrastructures and instead focus on product. In Addition, cloud-based ERP permits an organisation to access latest technologies in the marketplace, such as features that is vital in reducing the lead time to market. Researchers also acknowledged that there is rarely or no service outages in the cloud environment provided by reputable vendors because they are managed in a highly proficient style. Even in the case of an incidental outage, the services are restored almost instantaneously (Onyegbula, et al., 2011).

- iv) **Masked complexity**: Research also identified that the hardware, applications, and infrastructures of cloud-based ERP are upgraded and maintained in the cloud service vendor site. The entire process of maintenance is masked as it is not visible to the consumer organization (Gunawan & Surendro, 2014). The management end of the entire ERP can be quite complex. Hence, it is a relief that the end customers are not involved in the system maintenance. Allowing the ERP end users to focus on product or service development and core administration, managing, maintaining, and updating IT systems within their own organisation.
- v) **Intercompany collaboration**: The Intercompany collaboration of Cloud-based ERP encourages partnership between businesses, where they can leverage each other's resources to improve and revolutionize their business processes, with the intentions of increasing productivity.

#### **2.4 Functional units and its related ERP modules in a manufacturing environment**

A typical manufacturing organisation has different sections that can be referred to as functional units such as the Sales and marketing unit, Human resource and payroll unit, Account and finance unit, Production and supply-chain unit. Manufacturing and production in the 21<sup>st</sup> century have become the survival of the fittest, because for a manufacturing company to remain

in business, they need to continuously keep their customers/clients loyal to their products and services. Information and Technology has a strong connection with modern settings, especially the manufacturing environment with many rigorous processes, machines, materials and human resources. A manufacturing company needs a sophisticated and unified system that can integrate the functional units and communicate in real-time. Successfully implemented ERP system can handle various management challenges of an organisation, thereby increasing performance and achieving the strategic goals.

Enterprise resource planning plays a very important role in production scheduling process, inventory management, Purchase orders, Sales orders and materials requirement planning. Production schedule is used in the business process for cost and time efficiency. Recently, ERP software has become increasingly flexible, versatile and integral. The system is offered by various prominent vendors such as SAP, Oracle, JD Edwards. There are currently over than 100 ERP providers, companies ambitious to grow in their capability for ERP system. The manufacturing organisations now have less concerns in terms of inventory management and real-time visibility of the financial overview. The earlier a manufacturing environment adopts and investment in a suitable ERP system, the better the competitive edge. The biggest trends in ERP has been the Cloud-based systems.

There has been hype around cloud services, and the adoption rate is certainly high. Those who have embraced these technologies are likely to have a competitive edge over their peers when it comes to adding value to their businesses. However, if an organisation is planning to adopt ERP software, there are key requirements that need to be ensured for various departments/functional units, for instance the finance team wants to ensure that the system is fast and easy to merge financial data and important information. Manufacturing organisation

expects much from ERP system, because they involve many processes that needs integration to make information readily accessible throughout the organisation.

**Table 2.5 Functional areas and their business functions (Monk & Wagner, 2013)**

Functional area of operation	Sales and Marketing unit	Supply Chain unit	Human Resources unit	Accounting and Finance unit
<b>Business functions</b>	Marketing a product	Purchasing goods and raw materials	Recruiting and hiring	Financial accounting of payments from customers and to suppliers
	Taking sales orders	Receiving goods and raw materials	Training	Cost allocation and control
	Customer support	Transportation and logistics	Payroll	Planning and budgeting
	Customer relationship management	Scheduling production runs	Benefits	Cash-flow management
	Sales forecasting	Manufacturing goods	Government compliance	
	Advertising	Plant maintenance		

#### **2.4.1 Supply-chain unit (Inventory management module)**

According to Saud Al-Schniederjans & and Yadav, (2013) they explained that for any organisation that sells or manufactures products, inventory management system is a very important component of the ERP system. For instance, after receiving a purchase order, it needs to be updated in real-time in the inventory management system. The system always keeps the track of the current quantity of products continuously and value of inventory at all time. Because the inventory cost is almost one-third of the overall manufacturing cost. Hence, manufacturing companies are continuously striving to maintain low level inventory and

simultaneously keeping stock that satisfies the customer's demand at all time. A manufacturing firm needs to achieve this to maximize their profit. The company must also be extremely vigilant by maintaining most adequate level of "safety stock" to lighten the risk of stock outs to meet the order requirement of customers in a timely version. However, Inventory management is said to be one of the most challenging section within NMOs which can be due to inefficiency or corruption practices.

#### **2.4.2 Supply-chain unit (Purchase and procurement module)**

The ERP system purchase order keeps track of order status such as the information of received products and so on. When the purchase department sends an order to a supplier requesting for raw material or a finished product. After a purchase order is received from a customer, the sales department makes a corresponding sales order entry of the sale to complete the customer's purchase request (Schniederjans & Rao, 2010). When companies plan to order stock from their suppliers, the "purchase order module" gives account on product type and past purchases history. The history of the purchase order provides the business precise details of the purchase such as date, amount and delivery status and so on. ERP also enhances the manufacturing companies productivity, through material requirement planning by organising the Bill of Materials (BOM) which facilitates ordering the type and quantity of raw materials needed to manufacturing products on schedule (Monk & Wagner, 2013).

#### **2.4.3 Supply-chain unit (Production Planning module PPM)**

The materials requirement planning (MRP) determines the specifics of raw material orders such as amount and timing that is what and when. The materials requirement planning functions are incorporated in ERP systems, helping the manufacturing companies schedule and organize the type and quantity of raw materials needed for production to customer's specification. This function precisely estimates the purchase order considering various factors such as inventory

level, pending purchase orders, sales orders, work orders and forecasts. A manufacturing firm is assumed to be capable of meeting customers demand, therefore ERP system keep past records, present and forecast future needs for efficient planning and to avoid excess inventory (Ang, et al., 2012). The steps involved in managing the material needed for production links the sales and operation planning process, providing detailed schedule for the material requirement planning.

Hence, to handle inventory uncertainties a clever materials requirement planning (MRP) system becomes an essential component in ERP system. The MRP function facilitates predetermined and constrained capacity planning. According to Samjune (2014) without MRP, there may be discrepancies in manufacturing quantity, production timing, inventory level and purchased materials. Hence, with all the basic components in ERP software, a manufacturing firm can modernise their processes and use information more effectively throughout the organization. The Modern Enterprise Resource Planning software continues to improve and adopt new technologies, such as cloud computing, mobile applications, business intelligence (BI), big data, and so on. All these additions and integration is to improve and become an even more efficient and effective tool for manufacturing businesses and other applicable sectors.

#### **2.4.4 Sales and marketing unit (Sales and distribution module)**

The sales order documentations are gathered as soon as a purchase order is established from the customer. The sales team notifies the production floor if the materials required for manufacturing the products is available. Hence sales order will be changed to work order generated. These documents connect the shop floor as regards the product to produce and the materials needed to produce it. As soon as order is completed and ready to be shipped, collection list is created. The collection list directs what sales orders to be completed due

order's ship date and according to customer's specification. The ERP sales order uses shipping lead-time to calculate the shipping date.

An ERP system improves a company's sales order process because it uses a central database, which in turn helps to minimize data entry errors, tracks all transaction data and create precise real-time information to all users involved in the sales order process (Monk & Wagner, 2013). Taking SAP ERP sales and distribution for instance where important transactions and significant actions are assigned a number code solely for accurate record-keeping. Hence, keeping an electronic evidence which is regarded as "document". SAP ERP sales and distribution module is a cycle process which includes six events namely: Presales activities, Sales order processing, Inventory sourcing, Delivery, Billing, Payment.

#### **2.4.5 Human resources unit**

Human Resource module handles the HR & payroll unit activities. This module holds employee's personal details, salary information, attendance record, promotion updates, all staffs training and performance evaluation. This module supports HR team in effective management of human resources. An employee records is performance statistics is easily traceable including job descriptions, skill pattern, hours worked and attendance rate. The payroll system is quite important part of Human Resource module, it manages employee's salaries and complies it as part of the production cost report. This functional unit also track other expenses such as travels and reimbursement.

#### **2.4.6 Accounting and Finance unit**

This module records inflow and outflow of revenues and expenditures. The finance module manages all finance account related operations such as expenses, financial ledger, account balances, budget, bank financial statements, purchase invoices and payment receipts and tax records. Financial accounts statements are interpreted to support the decision making process

and the reports may be presented monthly, quarterly, and/or yearly. Therefore, the finance module is about the most crucial and critical module in an entire organisation. The place of sound accounting and internal control systems in any business, irrespective of its scale, cannot be overemphasized.

However, as a result of corruption practices prevalent in every society around the world today, which Nigeria is not an exception. Organisations are intensifying efforts to reduce and/or probably eliminate the act of “corruption” towards profit maximization. There are several research studies on trust-based systems that can be integrated into ERP systems to effectively reduce this corruption plague (Enofe, et al., 2017). Accounting and finance is said to be the most challenging functional within Nigeria organisations due to corruption practices. Hence, software vendors have started to respond by proffering solutions to this challenge. Those that are successful will in time become true solution providers (Ezeagba, 2017). However it is important to consider the technicality and cost of adoption for SME businesses, who cannot afford the complexity and cost of such an accounting system. (Ezeagba, 2017).

## **2.5 ERP critical success factors (CSFs) in developing and developed Countries**

Critical success factors (CSFs) can be described as key elements necessary for an organisation to achieve success, they are the areas of business that are crucial to success. The concept of critical success factors (CSFs) was developed as far back as the 1960s. Ronald Daniel first discussed the idea of CSFs in the management literature, stating that information analysis must focus on "success factors" as a new approach to help achieve organizational goals (Bullen et al., 1981). The critical success factors are areas of activity that should receive constant and careful attention from management. Critical success factors represent what the management considers critical for the success of their organisation.

Critical success factors (CSFs) are often used to identify and state the essential elements required for the success of a business operation (Hossain et al., 2001). Once the CSFs are identified by the management, they are clearly stated and closely monitored. CSFs can also be described in more details as a small number of easily identifiable operational goals shaped by the industry, the firm, the manager, and the environment that assures the success of an organization (Leyh et al., 2015). Critical success factors (CSFs) provide an overview of what is essential for successful ERP implementation (Saade et al., 2016). It is a common occurrence to establish CSFs in an ERP implementation, but despite the large amount of research available on CSFs, ERP implementation failure is still common (Ram et al., 2014).

For ERP projects, CSFs has been defined as a reference to any condition or element that was deemed necessary for the ERP implementation to be successful (Finney et al., 2007). It is considered as a set of activities that needs special considerations and continual attention for planning and implementing an ERP system. CSFs are particularly useful, as they provide clear insight and guidance on where to focus special consideration and resources and continual attention in planning for successful ERP project implementation. There is considerable debate, though, as to whether CSFs are universal or not. Some researchers believe that CSFs are universal and reusable and can be applied in all situations (Borman et al., 2013).

On the other hand, others researchers argue that CSFs differ depending on which company, industry and management that is being observed (Bullen et al., 1981), and as a result, it is difficult to make a generic compilation of CSFs that can be applied to all ERP implementations. The literature review tracks recent academic literatures to find research in this field. Some researchers produce their CSFs after their investigation. Other studies give a compilation of previous research by making a list of CSFs and rank them in importance. However, according to the literature, there is a level of consensus between the developed and developing countries

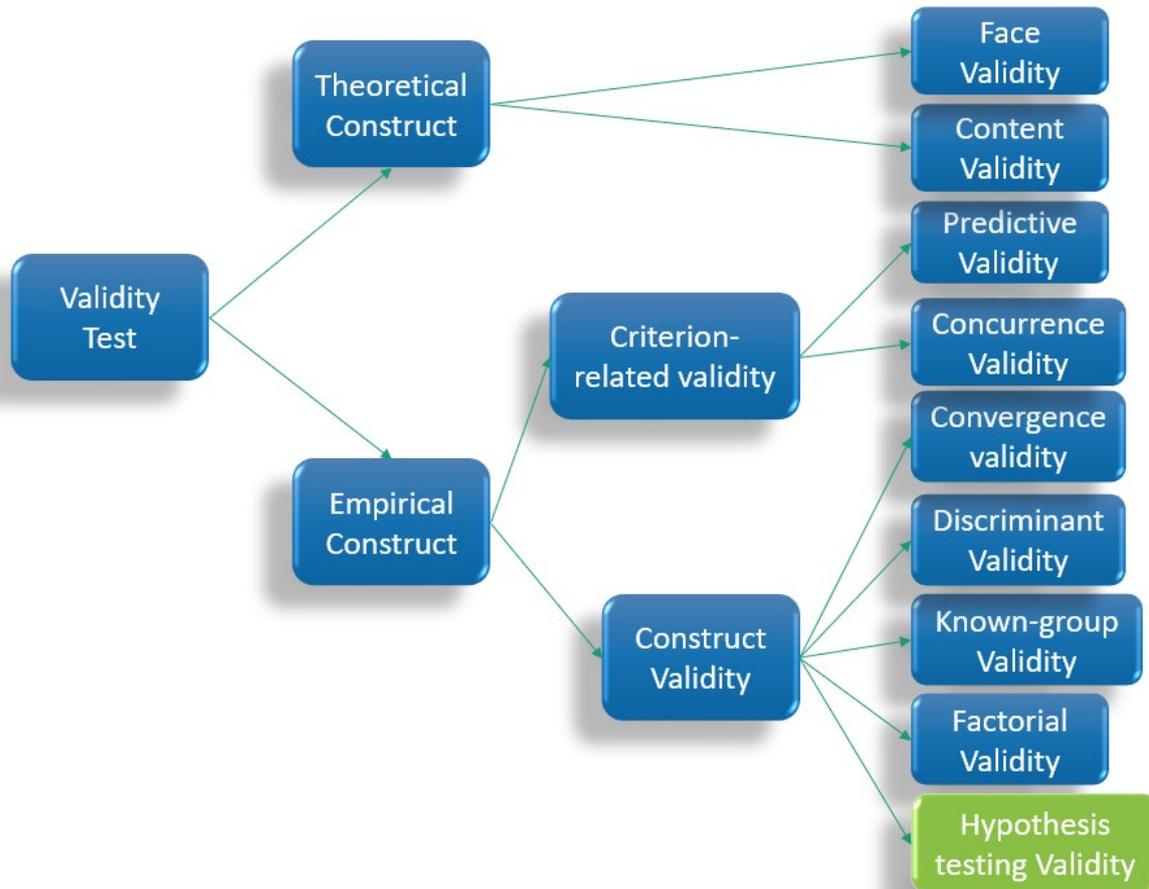
for ERP critical success factors (CSFs). These are the factors gathered with highest consensus among ERP manufacturing consultants and academic scholars (Goldston, 2019), as discussed below;

- **Top management commitment** : This is considered to be very important to a successful ERP implementation in a manufacturing organisation. Management support and commitment is a company-wide empowerment. ERP implementation should be viewed as a strategic initiative rather than as a technology upgrade project. Also, change management can be embedded into the “top management commitment” because change readiness can be aligned with the responsibility of the management providing support across the organisation (Goldston, 2019). However, the management may encounter resistance from employees across the organisation, which may sometimes require a different leadership approach and consistent commitment.
- **ERP fit with organization** : Technology adoption and implementation have aided tremendous improvement in communication and comprehensive visibility in manufacturing organisations. According to Goldston, (2019) ensuring ERP system interface simplicity makes it usable by the employees, this mitigates resistance, thereby adding to its fitness for the organisation. To achieve ERP fitness in a manufacturing organisation, frontline employees' contribution is required during implementation; such a collaborative approach will lead to increased user satisfaction. According to (Madininos, et al., (2012), for an ERP implementation to be successful it is important that the enterprise should choose an ERP system that is suitable and fit for its own business processes, strategy, structure and environment.
- **Quality and seamless data migration** : The literature shows the data quality and migration seamlessness can be categorised into seven measures (Goldston, 2019); (i) Data quality (ii) Compatibility (iii) reliability (iv) timelessness (v) information

relationship (vi) authorization (vii) ease of use. There several critical manufacturing details such as procedures, specifications and manuals that needs to be carefully and seamlessless transferred to the new ERP system.

### **2.5.1 Study Hypothesis**

Hypothesis can be referred to as a tentative statement that indicates a predicted relationship between variables, derived from existing knowledge or literatures. They can be measured, quantified and either or not supported. For instance, in the case of technology adoption, there is a social theory stating that customer satisfaction can be as a result of technology adopted by an organisation. However, statement of this theory can be used to derive hypothesis stating a correlation between customer satisfaction and technology adoption in an organisation. If there is a substantial evidence that supports, the hypothesis. Then we can agree that there is a high degree of construct validity in the measurement. The figure below describes a graphical representation.



**Fig. 2.5 Subtypes of different forms of validity tests (Bolarinwa, 2015)**

A number of hypotheses were established based on extensive literature study. As a result of the relationship between “ERP implementation critical success factors” and “organisational performance” as seen in the literatures. Therefore, critical success factors (CSFs) for implementing ERP system within the Nigeria Manufacturing Organisations (NMO) are identified and correlated with organisational performance. The selected variables consist of different factors influencing ERP implementation success such as; Top management support, ERP users efficiency” (staff’s skills and training), ERP Data quality, ERP ease of use, ERP fit for organisation and ERP Project Management. Therefore, the hypotheses below will be tested in chapter 5 and 7 respectively:

**Hypothesis 1 (H<sub>1</sub>):** There is a positive significant relationship between “Top management commitment” and “Organisational performance”.

**Hypothesis 2 (H<sub>2</sub>):** There is a positive significant relationship between “ERP users efficiency” (staff’s skills and training) and “Organisational performance”.

**Hypothesis 3 (H<sub>3</sub>):** There is a positive significant relationship between “ERP Data Quality” and “Organisational performance”.

**Hypothesis 4 (H<sub>4</sub>):** There is a positive significant relationship between “ERP ease of use” and “Organisational performance”.

**Hypothesis 5 (H<sub>5</sub>):** There is a positive significant relationship between “ERP fit for organisation” and “Organisational performance”.

**Hypothesis 6 (H<sub>6</sub>):** There is a positive significant relationship between “ERP Project Management” and “Organisational performance”.

## **2.6 Overview of Information Technology (I.T) Adoption in Nigeria**

Information Technology (I.T) is an important factor for competitive growth of an organisation's regional and global market. Manufacturing firms are forced by competitive pressure to compete for new customers and market. Hence, I.T has a direct connection with business competitiveness. Information and data processing are the fuel of modern business and successful organisations today are those who take advantage of the most relevant I.T (Grant, et al., 2010). The emergence of various modern I.T's enables market participants share information and transfer goods nation-wide and internationally across borders increasing global network. According to Aremu & Shahzad, (2015) studies, IT adoption and implementation is a crucial influence to enhance manufacturing in developing countries such as Nigeria.

Nigeria aspires to be categorized among the first twenty economies in the world with a huge GDP of \$900 billion by the year 2020 (Onoh, 2017). The literatures have identified that the vision appear invisible due to incessant corrupt practices and poor regulatory policies and government supports (Eze, et al., 2013). Contemporary studies indicated intense I.T adoption as a requirement for economic growth and towards and beyond vision 2020 accomplishment. The lack of efficient IT is one of the most significant factors that adds to the extensive gap between developed and developing countries such as Nigeria. Manufacturing companies in developed countries such as Singapore, South Korea which Nigeria was at sometimes been at equivalence within the 1970s, have been effectively adopting and continuously implementing IT, yet the IT adoption rate in Nigeria is still very slow and inefficient (Lal, 2007).

### **2.6.1 Information Technology (I.T) Adoption Barriers in Nigeria**

There are Internal and external categories of barriers that hampers the adoption of IT in developing countries (Kapurubandara & and Lawson, 2016). The internal barriers include management, organisation's characteristics, cost and return on investment (ROI). The external barriers include, infrastructure, social, cultural, political, legal and government regulations. According to Lal (2007) findings on the adoption of IT in Nigeria, the study found that one of the main reasons impeding IT circulation and extensive use is as a result of poor physical infrastructure. Furthermore, some of the IT challenges may include lack of research and development, legal and regulatory issues, weak IT strategies. (Apulu & Latham, 2011) amongst others, acknowledged few more factors that influences the adoption of IT in Nigeria.

Some of the factors include lack of infrastructures, funding, implementation cost, lack of knowledge, government supporting policies, inadequate skills and training, cultural factors, electricity limitations, corruption, semi-illiteracy, improper information, and so on. (Eze, et al., 2013) highlighted that issues relating to IT adoption in Nigeria and its development have been

handled badly by the government and indicated problems such as infrastructural and cultural factors, as working against the development and implementation of IT in Nigeria. Other researchers (Irefin, et al., 2012) also referring to the same factors affecting the adoption and implementation of IT in Nigeria, these factors includes; poor infrastructure, cost of IT, government and management support respectively. (Sajuyigbe & Alabi, 2012) stated firmly that lack of finance, electricity, skill personnel and government support are the main factors that affects extensive IT adoption in Nigeria, also highlighted that the characteristics of an organisation is an influential factor to the adoption and implementation of ITs.

### **2.6.2 Information Technology (I.T) Limitations in Manufacturing companies**

There are cases where expensive Information Technology project have failed to fulfil the expected goals of the managements (Sajuyigbe & Alabi, 2012). Issues highlighted in the previous sub-section are more extended in this sub-section, presenting classification of IT infrastructure limitations in Nigeria's manufacturing organisations.

❖ **Business Process Reengineering Issues:** In global competitive market, manufacturing organisations continuously pursue productive means to survive and perform better than their competitors. Literature addresses the management approach about business process re-engineering that is global adopted by manufacturing organisations aiming to achieve tremendous increase in performance and cut cost in long run. Business process re-engineering is essentially the complete re-design and revamp of the entire business processes to realise huge enhancements and measurable performance in terms of profit/revenue, quality of production and services. Although, the increasing emphasis on re-designing entire business process has caused a significant drift in the way information systems are implemented in the developing countries due to the fear of failure.

❖ **Implementing non-integrated Information Systems:** Manufacturing Organisations

always attempt to reduce their expenses in order to enhance their financial strength (Moohebat *et al.*, 2010). Literatures also spotted that implementation of expensive non-integrated IT infrastructures often does not achieve the expected goals, which may result in organisations losing sales, reduce service quality and therefore creating a negative effect on the organisation within and externally. This is often a limitation for manufacturing organisations. Thus, they need to focus on reducing the expenses of running and maintaining non-integrated IT infrastructure and as a result, reduce the redundancy of information and systems (Mantzana, *et al.*, 2008).

❖ **Management's Decision-Making Process:** Literatures highlighted the management's decision making process and the necessity to support in the management with coordinated data improve the chances of IT infrastructure implementation that will integrate the entire organisational functions. On the other hand, the limitations in manufacturing organisations is that IT infrastructure selection requires the management to take precise decision based on their need which may require rigorous selection process and decision (Irefin, *et al.*, 2012). The bases for the selection include information systems reliability, business functional requirements, vendor support efficiency, cost of implementation, compatibility with existing procedures for instance, implementing disparate applications that were not compatible with each other and requires intensive customization may leads to failure.

### **2.6.3 The Need for ERP Systems in Nigeria's Manufacturing firms**

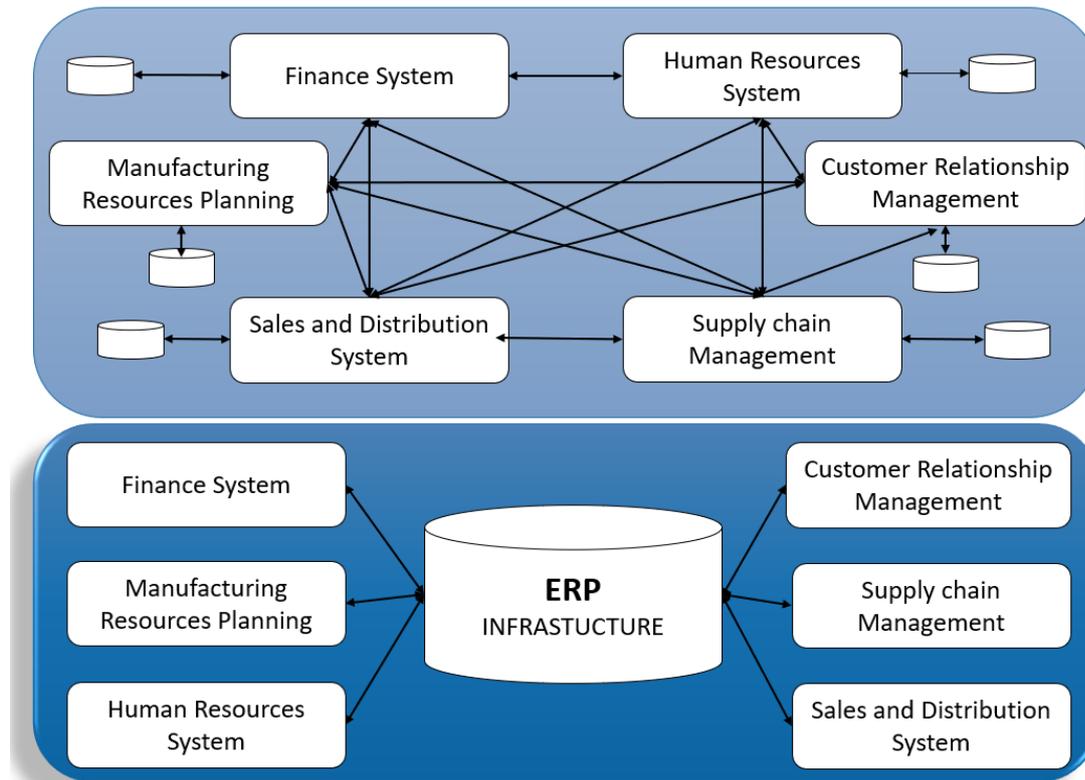
The limitations assessment in manufacturing firms, shows that the conventional information systems existing in most Nigeria's manufacturing firms are not efficient enough to provide a global competitive performance. Supporting this argument is (Chang, *et al.*, 2008) they suggested that this type of IT infrastructure does not provide efficient organisational and departmental interaction and communication within the organisation. The justification behind

this is that conventional IT systems do not fulfil the global logistics needs. This indicates that Nigeria's manufacturing firm needs an integrated information and communication technology solution to overcome their IT infrastructure limitations. The need for an integrated IT infrastructure may also be required to monitor several technological projects that were either never implemented or abandoned immediately after initiation. As a result of various challenges such as data integration or security interoperability that are typical in nature, remains apparent at developmental and functional levels (Liu and Seddon, 2009).

Also, even at present many organisations in Nigeria have no knowledge of ERP. They had implemented non-integrated information which may even cost more or otherwise, but it will only support a single functional unit. That means, a company would have implemented sales and marketing information system, a production system, accounting system and so on (Aremu & Shahzad, 2015). These individual systems different database and various means of processing data. They can be rather referred to silos, one each belonging to one department with no connection whatsoever, that is each silo does not communicate with each other in same organisation. Although, such system might work well individually in a functional area within its assigned department. But in a global competitive environment a company must share data in real-time within its functional units (Assma, et al., 2017).

Another grievous implication of non-integrated information system is multiple entry of the same data which can result in costly inefficiencies. For instance, in Nigeria, considering two departments with their individual information system. Sharing of data requires a clerk or the representative of each department to transfer or sometimes print documents from one department to input the data in another department's information system (Sajuyigbe & Alabi, 2012). Additionally, data can vary in different systems due to time lag in updating the system, the transferred data would hardly be up to date. Products might be referred to by different part

numbers in different systems, this variance can create further issues in timely and accurate information sharing between functional areas. This takes twice the time and increases the chances of missing data and data entry errors. Apparently, the need for ERP is obvious so that this process can be automated. Hence, if an information system write data to a file it can be read by other departments in a unified information system.



**Fig. 2.6: Conventional IS Approaches verse ERP system (Al-Fawaz, 2012).**

Nigerian government are becoming oriented towards building a resilience economy, after facing a massive recession in the country that lasted more than three years. Literatures revealed that Nigeria's economy is highly vulnerable to external shocks particularly the price of crude oil per barrel, due to huge dependence on the crude oil sector. Lately, the Nigerian government have intensified support for ICT adoption and implementation by creating a scheme referred to as Economic Growth and Recovery Plan (EGRP) this scheme focuses on improve entire economy of the country. It emphasise on manufacturing organisations requiring them to

upgrade their IT infrastructures by integrating functions operational activities in order to enhance competitiveness in the global marketplace (Erumebor, 2017). Chang et al., (2008) suggested that such approach when applied to develop an integrated IT infrastructure will create a leading driving force.

## **2.7 ERP system adoption in Nigeria Manufacturing Organisations**

According to the literatures in recent years, there have been massive adoption and implementation of ERP system in Nigeria but there it is not clear the extent of ERP system knowledge with the Nigeria manufacturing Organisation (Awolusi & Onigbinde, 2013). Organisations are categorised by their sizes and they are commonly distinguished by staffing capacity and revenue turn-over (Damirchi & Rahimi, 2011). Nigeria small and medium manufacturing organisations, are said to have two specific issues, which are ERP selection and its implementation. This is because there are only few records of antecedent critical success factors (CSFs) for ERP adoption within the Nigeria manufacturing organisations (Awolusi & Onigbinde, 2013).

ERP system vendor selection process tends to be quite difficult. Most ERP packages have similarities and at the same time have vital design differences. The selection may involve reviewing the perception of various stakeholders whose involvement would be crucial, such as staffs, suppliers, and customer reviews (Rajan & Baral, 2015). An ERP vendor that provides a simple system might offer smart and easy to learn system administration tools, a relatively reliable interface because simple interfaces could reduce the implementation time.

In the case of large organisations, there are various selection criteria of ERP systems, which are well documented (Van Everdingen, et al., 2000). The factors to be considered, include the suitability, stability and history of the ERP vendor, implementation support from vendors and improvement in their ERP packages. Unlike SMEs there are several studies to support different

characteristics of the ERP system selection process for large sized organisations (Kapurubandara & and Lawson, 2016). Particularly, fields of software packages which is considered and that to be chosen. Analysis conducted has shown that the organizational size is of significant influence on the software package selected.

The option of SAP R/3 systems are preferred or selected more often by large organisations, while small or medium sized (SME) companies often choose software supplied by Baan which is now called Infor ERP LN and others (Ayres, et al., 2019). There are more total of 29 different ERP selection benchmarks which have been identified; the norms of adaptability and flexibility of the software is more valued by SME organisations. Studies conducted by (Van Everdingen, et al., 2000) identified the implementation duration and costs is given more importance, because funding is highly considered. Related study shows criteria such as Fit for purpose, the flexibility, simplicity, and implementation duration has also been found in the study of European midsize companies.

**Tab 2.6: Enterprise Category definitions (Damirchi & Rahimi, 2011)**

Measures			
Enterprise Categories	Number of staffs	Turnover	Balance Sheet Total
Large	>250	≥€50 million	≥€43million
Medium	<250	≤€50 million	≤€43million
Small	<50	≥€10million	≥€10million

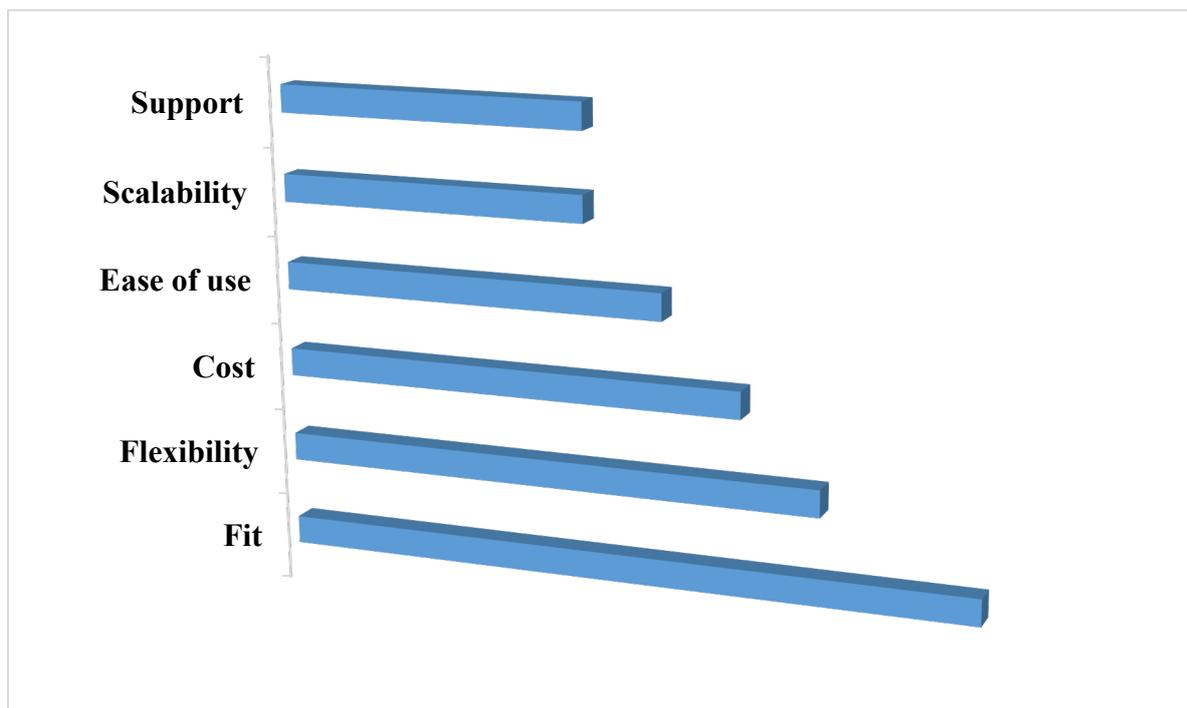
Considering the evaluation of ERP vendor's perception, they reported that the mid-markets focus more on the product features which include the functionality and quality of the product, rather than on characteristics of the ERP vendor. The vendors also indicated that, the implementation time, ERP system compatibility with existing applications and cost are the important vendor selection criteria. According to Spratt (2000) who identified four basic

selection criteria that organisations might use to choose the supplier of an enterprise resource applications, namely, applicability, integration, adaptability, and upgradability. Also analysed critical planning issues prior to ERP adoption decision, which include assessing the need for ERP system, choosing the right system features that requires less customization and align with organizational economic and strategic justification. The competitive strategy was also reported such as, targeted market segments, customer requirements, manufacturing environment, characteristics of the manufacturing process, supply chain strategy and available resources all enter the decision of ERP adoption.

The usual point where the senior management of an organisation starts to think about adopting the ERP system could attributed to difference circumstance such as competitive edge, improving the organisation IT status either due to customer requirements or to meet up with policy and standards. According to Teach (2016), the need occurs when a company management starts to feel the stress cracks of such things like QuickBooks system or Excel spreadsheets that the organisation are using to manage the business. The author further explained that when a company is experiencing fast growth, they seem to feel the stress in stages. Hence the top management starts to realize that they do not have grip on what is going on within the organisation in terms of inventory management and real-time visibility of the account and finances and more. At some point the management feels like they cannot grow or scale the company under those circumstances, so they realize that they need system that can give them more precise information, enhanced visibility, and more integrated information.

Organisations considers buying a new product, when it is perceived that the product will play an important role in improvement of their processes and daily operations. Most especially the characteristics of the ERP system must fit into the measures and criteria used by the organisation to select new information system. According to the survey carried out by

(Everdingen, et al., 2000), the participants were requested to indicate most important criteria for selecting their current information system in their respective organisations. The data received shows that cost, user-friendliness, fitness in business procedures, scalability, support and training, the result obtained indicates that best fit with the business procedures is most rated, this is shown in the figure below.



**Fig. 2.7: ERP selection criteria by ranking (Everdingen, et al., 2000)**

Most of the participant mentioned that best fit in the top rating of the selection criteria ranking. Hence, system compatibility and fitness with business procedures seems to be the major issue for organisations to decide on a new system, as a result vendor have given much attention to allow easy configuration of packages to fit into the existing business processes, as it is already known that configuring and implementing ERP can be costly because it may need the re-engineering of the entire organisation business operation. Therefore, there is more potential for

an ERP system that succeeds in accomplishing this main selection criterion “compatibility and fitness with business procedures” and cost effective.

It was also discussed in some earlier literatures that ERP vendors faces more complex problems than the adopting organisations. According to Sprott (2000) the problem may be studied from two cogent perspectives, developing and marketing the product challenge for the vendor while implementation and integration issue is for the customer. Another explanation used to describe selection criteria is the theory of planned behaviour which was introduced by Ajzen suggested that attitude might not completely explain one’s behaviour (Costa, et al., 2016). Hence, based on the theory Ajzen presented that the subjective standards such as social factors and the perceived behavioural control also has important role in new system adoption.

The enterprise resource planning system is at the core of many firm already but making the employees/users to use this high-cost implicating system and time-consuming project seems to be one of the most important issues to recon with. (Costa, et al., 2016) Studies the key determinants that encourages user satisfaction and adoption, they had conducted an online survey and developed a theoretical model towards understanding ERP users’ perspective in such case. The result indicates that top management commitment and support, training coupled with the quality of the system are important to assess adoption and the user satisfaction.

## **2.8 Nigeria’s Economic Growth and Recovery Plan (EGRP)**

The oil and gas sector is the most thriving source of revenue for the Nigerian government because it makes almost 94% of the entire export earnings and also constitutes approximately 62% of the total government revenue (Recovery, 2017). The instability in economy and high reduction in global oil prices in the global market have contributed significantly to the recently ended nationwide recession which started in 2016 and ended in 2019 (Ademola, 2018). In

response to providing solid foundation for the economy to emerge out of recession and restore economic growth, on 7th March 2017 the incumbent government of President Muhammadu Buhari released a scheme called “Economic Recovery and Growth Plan (ERGP)”, with year 2020 vision a medium term plan of significant change. This scheme builds on Strategic Implementation Plan (SIP) which was initially developed for the 2016 budget. The ERGP aims to achieve sustained comprehensive growth, enhanced by principles that focuses on tackling constraints to growth, Optimizing the potency of private sectors; promoting national cohesion and social inclusion, encouraging functional markets and protecting core values in Nigeria’s Constitution (Erumebor, 2017).

### **2.8.1 Strategic objectives of ERGP**

- ❖ Reinstatement growth trend via substantial economic stability and diversification.
- ❖ To achieve a globally competitive economy by focusing on advance infrastructure, investing in businesses, and promoting mass digitalization.
- ❖ Investing in the Nigerian youth capabilities by creating more jobs, promoting interpersonal skills and knowledge transfer, social inclusion, citizens empowerment and improved human capital.

Earlier Plans of the previous government failed and delivered limited results. Hence, the present administration hope to succeed by improving the performance of the current plan. They introduce set of six significant features.

- ❖ A solid political commitment with a focus on implementation is reflected in the establishment of a delivery unit in the Presidency with constant follow up and evaluation practice by the ministry of Budget and national planning (MBNP)

- ❖ Sacrosanct initiatives to raise oil production to 2.5mbpd by 2020, also the privatisation of some selected public institutions, restoring oil refineries and oil producing community's environmental conservation, especially the Niger Delta.
- ❖ Combining the plans of the former regime such as “National Industrial Revolution Plan (NIRP)” and “Nigeria integrated Infrastructure Master Plan (NIIMP)”
- ❖ Substantial support for the private sector to become the hub of national growth and development with supporting policies for science and technology adoption.
- ❖ Incorporation of Budget and Planning into MBNP to allow proper alignment between Budget and planning for effective execution.
- ❖ Partnership with State Governments to achieve joint goals and direction.

## 2.9 Conclusion

According to literatures the cost of adoption, business size, availability of IT infrastructure, government support, and management support are the factors that influence information technology adoption (Irefin, et al., 2012), but their analysis showed that cost is a major barrier for adopting IT system among the other highlighted factors. Also, (Adebayo, et al., 2013) stated recommendations pointing to the government support, hence the government needs to support the adoption of IT by providing adequate Information and Communication infrastructure in the country such as internet, so that it will be relatively easier to adopt IT rather than finding a way to avoid it.

Hence, according to studies highlighting factors such as cost, skills and training, management support; cost appeared more frequently to be the most significant factor for affecting adoption. The research questions addressed in the literature review include: question one(1) sub-section 2.7, question two(2) sub-section 2.6.1, question three(3) sub-section 2.4, and question four(4)

sub-section 2.5. Although, ERP adoption and implementation is not a new area but there is reasonably limited research conducted in Nigeria and specifically for manufacturing firms.

There are existing implementation models, this research assert that all the previous studies are relevant and they are steppingstones to other findings. However, their applicability in Nigeria's manufacturing firms may be questionable. The chapter established a critical review of IT adoption and implementation generally and the need for ERP in Nigeria. Although, there are quality existing non-integrated IT system in some manufacturing organisations in Nigeria. Irrespective of that, the lack of integration is a huge limitation, hindering organisations towards maximizing their production potentials. The research issues from critical review of the literature in this chapter are itemized below.

## CHAPTER 3

### CONCEPTUAL MODEL

#### 3.1 Introduction

The Nigeria manufacturing sector contribution to the country's GDP has been very low over the years, it presents a negative growth record in 2016 (Chete, et al., 2014). To restore growth and economic diversification, Nigeria "Economic Recovery & Growth Plan" (ERGP 2017) seeks to turn the fortunes of the sector to 10.6% and above by 2020 (Ademola, 2018). In support of this vision, this study seeks to investigate the adoption of advance technology such as ERP to drive the Nigeria manufacturing sector. This part is structured to discuss conceptual model of adoption and implementation framework.

Organizations ranging from the public to private sectors, large to small enterprise in both developed and developing countries have distinctive basic leadership forms, organisational structures and cultures which contrasts from one way or the other (Asemi & Jazi, 2010). It might be conceivable that organizations in Nigeria manufacturing organisations (NMO) focus on various criteria for Information system adoption. Hence, there may be a need to discuss conceptual model towards the adoption criteria and critical success factors seen in the literatures to ensure a successful ERP implementation project in this sector (Al-Fawaz, 2012).

However, there are few ERP systems execution model and systems inferred from the literatures, there are few studies that supports the ERP selection and usage with regards to system classification, benefits, awareness, and reliability factors in developing countries. The Cloud ERP is classified to be recently replacing the implementation of the traditional ERP system due to its continuous advancement and Cloud ERP is cost effective suitable for large and SMEs in Nigeria. This section utilizes the "Technology Organisation and Environment" (TOE) framework in conjunction with the three dimensions of change (People, Technology

and Process) as introduced by (Heeks, 2002; King-Turner, 2014) to investigate how ERP implementation can improve towards organisational performance/productivity.

### **3.2 Conceptual model for ERP adoption in Nigeria's manufacturing organisations**

Academic writings in the past decades, shows ERP has been widely researched (Johansson, 2013). Besides, various ERP frameworks have been presented and studied, likewise outlining various influential factors. This research addresses the influencing factors by combining the “TOE framework” with “change management” in the Nigeria's manufacturing sector. To improve the decision-making in enterprises of developing countries especially Nigeria's manufacturing firms. Implementing ERP is asserted to be an important milestone towards continuous improvement in an organisation. But the system Implementation can only be considered successful when the organisation achieve its goals (Wang, et al., 2008; Yu, 2005).

Hence, Manufacturers association of Nigeria (MAN) was the accessible source of reference in this area which will explicitly talks about the influencing factor for Integrating information System/technology in Nigeria manufacturing firms (MAN, 2017). This research trend basically aims to replace the conventional paper documentation and standalone software models. The sharp progressions in all spaces of human activity opens new doors for the improvement of manufacturing and production. Things that appears quite impossible 25-30 years back, such as online instalments, e-banking, and e-pocket, are now a bit of our ordinary everyday activity currently (Sajuyigbe & Alabi, 2012).

There are key aspects of change that gives frame to effecting the organisational transition, of an ERP system implementation (Heeks, 2002). Also, considering the wide gap to be filled during transition i.e. a gap between where a manufacturing organisation may be at present, compared to where it needs to be for a successful adoption of ERP system. There are significant changes that needs to occur, which include staff's skills, operation processes and technology

capacity. Other changes might occur which may be categorised as an element in the three major dimensions namely, (people, process, and technology).

This chapter focused on developing ERP implementation model for manufacturing organisations, after evaluating factors that influence its adoption and implementation. In line with Heeks model (King-Turner, 2014), this conceptual model was conceived based on peculiar factors to the manufacturing organisations in Nigeria, technology adoption and their environment. According to Markus & Tanis (2000), they argued that in order to effectively evaluate the significance of change during ERP implementation, there is a need to link the framework to Implementation phases.

**Tab 3.1 Conceptual Framework (Rezaeian, 2016; Usman, et al., 2019; Raji, 2018)**

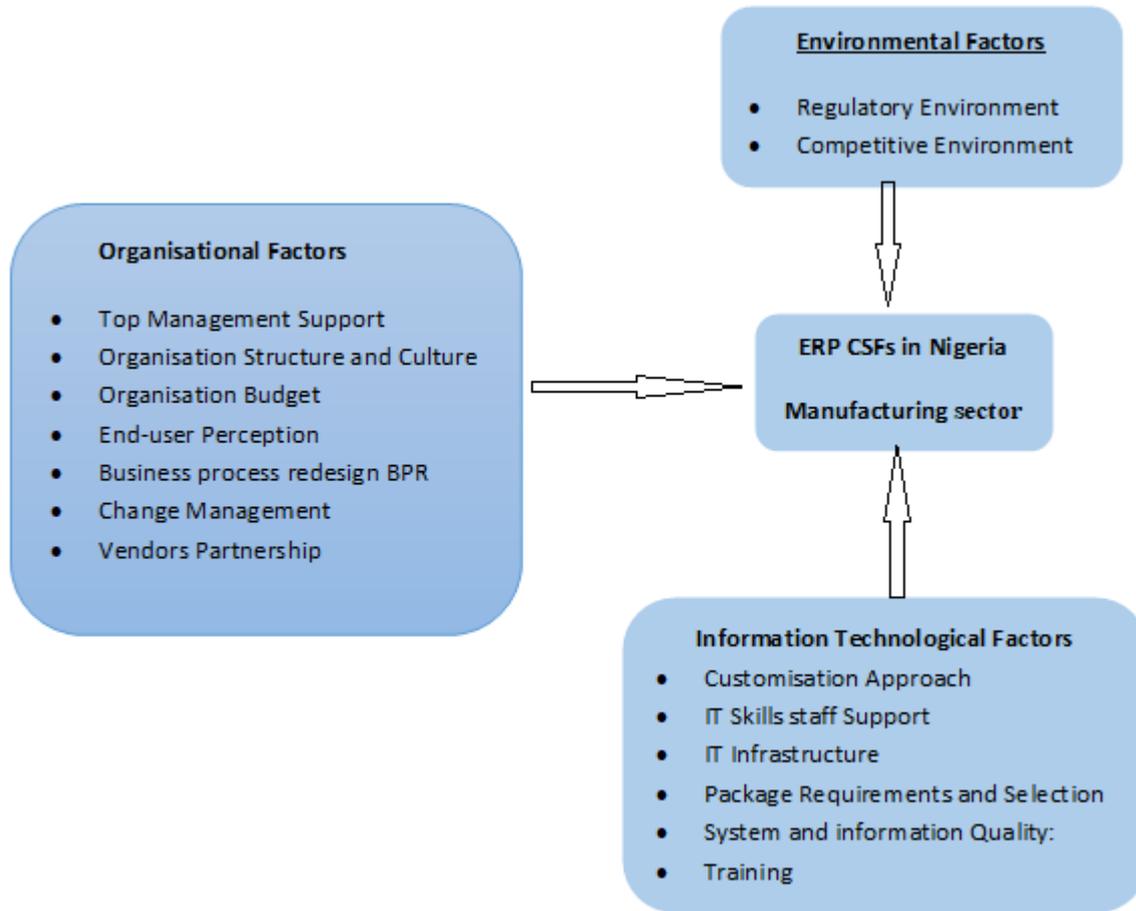
		Technology	Organisation	Environment	
		Technology	People	Process	
				Internal	External
<b>Pre-Implementation</b>	Selection and Preparation	System Cost	Literacy and IT skills	Process Structure	Competition
		Customization	Awareness and Perceptions	Process assessment	Stakeholders Pressure
		Reporting format	System Champions		Regulations
		Module Selection	Project board and Team Selection		
<b>Implementation</b>	Module deployment	Module deployment	Top management commitment	Documentation	
		Implementation process	Training and development	Standardization	
		Data quality & consistency	Project Management	Business Process redesign (BPR)	
<b>Post-Implementation</b>	ERP upgrade and maintenance	Upgrades and Maintenance	User Satisfaction	Process improvement	Customer Satisfaction
		Data Accuracy	Upgrade Training	Communication process	
				Documentation	

### **3.3 Influencing factors towards ERP adoption and Implementation in Nigeria**

These are the reasons that make managers or management in charge of technology projects resists new technology adoption such as ERP. The resistance can be due to little amount of studies conducted on various ERP selection, adoption and implementation in regions such as Nigeria. The substantial critical success factors (CSFs) identified in the literatures are related to countries in Europe, Asia, Australia, and other developed countries. According to Esteves & Pastor (2000) they grouped CSF's into organizational and technological group. Also (Sun, et al., 2005) introduced a system of listing orders of ERP CSF's execution, comprised of the management/organization, process, technology, data, and individuals.

While on the other hand, (King and Burgesss 2006) present a consolidated framework of ERP success/failures demonstrating a series of improvement processes, staffs, organization. In the literatures a few factors were highlighted which plays important roles in the ERP adoption alongside its implementation and it gives deeper knowhow of the entire process. These components give adequate help to think about the absolute most critical factors for developing an ERP acceptance alongside its implementation model in Nigeria. Influencing factors to help in creating a conceptual model for ERP acceptance alongside its implementation in Nigeria (Sun, et al., 2005; Aremu & Shahzad, 2015).

However, this study, investigates, categorise, and rank the influencing factors for ERP adoption and implementation in Nigeria's manufacturing organisation only.



**Fig 3.1: Influencing factors towards ERP success within the NMO**

### 3.4 The Organisational (People) Factor

The need for improved concept that causes change or upgrading in an organization requires co-activity from the organizational top management and other key staffs and active outer investors. This may incorporate the help from the top administration for assets distribution, representatives to design and to structure the framework necessities, consultants to give professional counsel, clients from different functional offices and trained staff. The Stakeholder's management classification is pivotal in a new system adoption because can of resistance to change and organizational dormancy in embracing new norms and working strategy into the current organizational culture. Aside of getting staff's ready to acknowledge

the innovative framework, another significant component is training them to utilizing the new software.

This turns into an ordinary component amid the entire lifecycle and it's well-known by numerous writings in the ERP research. Significance of stakeholders is an important element for success has been reverberated in various literature such as (Somers & Nelson, 2004). The ERP system selection is basically impacted by what the organisation aims to achieve, strategic plan and the available resources in place in terms of infrastructure. Analysis for internal enhancements in analogy with gap analysis and for the purpose of 'market fit' provides the basis for adopting, selecting, and designing information system such as ERP.

Hence, the ERP framework to be adopted depends on the suitable fit between the essential requirements of an organisation and the qualities incorporated in the system is very crucial. According to the studies of Hong & Kim (2002) stated in their research that a successful ERP execution depends mostly on the fitness of the system to suit that organisation to reduce customization to the barest minimal during the implementation. The organisational fit viewpoint can be simply related to quality definition "fit for purpose" there are other factors to be considered such as the organisation's resources, project team's skill level and the specific needs of the organisation become germane success factors. Also, the orientation that exists between the IT strategy and the business strategy poses to be very important in the implementation of an ERP system.

### **3.4.1 Top Management Commitment**

Top administration committed focus and backing is necessity for effective ERP frameworks reception and execution in associations (Upadhyay, et al., 2011) (Wang & Chen, 2006). ERP project implementation requirement includes endorsement of the management of designated board handling resources such as, money related and staffing/ human assets (Parr & Shanks,

2000). The executives' endorsement is normally founded on business case evaluation of new activities, thus, this will be initial phase during the time spent appropriation, a best need freely and unequivocally recognized (Nah, et al., 2001).

This leads committed and supportive management an essential element for ERP reception and execution (Dawson & Owens, 2008), (Al-Mudimigh, et al., 2001) take into consideration top management support in pre-implementation phase as an elementary requirement of starting up the ERP adoption vision and development. The significance management support for successful ERP acceptance alongside its implementation is highly acknowledge (Chwelos, et al., 2001). In ERP projects there is always a vital need for a high-level executive that has experience, expertise, and influence to establish goals and manage the transformation phase. For example, this can be in the form of project champion who understands the overall system's benefits and can promote them to the rest of the organisation.

Statement from the last contention is buttressed by (Law & Ngai, 2007) reported that while using intimately with the ERP clients in effectively embracing and executing ERP arrangement, fundamentally expands the cooperation in the midst of the business sector and thus, settling any inconsistencies ends up achievable. There are different scientists who additionally represent the significance of best administration backing (Somers & Nelson, 2004). The last analysts likewise emphasize various key segments of management bolster, for example, project confirmation, recognizing the essentialness of the project and attaching priority to it, the top administration inclusion, protecting and backing up the project, go about as a go-between in the midst of gatherings during contradiction, taking an interest inside the corporate strategy, understanding ERP software and its associated problems, proper sharing of assets to the project. The commencements highlight that committed management also impact ERP acceptance alongside its implementation in the context of SME businesses in Nigeria.

### 3.4.2 Organisation Culture and Structure

The literature identified the influence of organisational culture and structure on the adoption and implementation of ERP. According to Remus (2007) finding, reported that for employees to collaborate effectively, an organisations is required to know and understand their structure and cultural concepts. These concepts include collaboration, experience, principles, and standards (Skok & Legge, 2002). Organisational structure and culture that concentrates on continuous training and innovation can significantly influence the overall success of the IT modernisation plan of an organisation. (Scott & Vessey, 2002) provided case study-based evidence that organisational structure and culture are important success or failure factor of ERP implementation process.

Organizational culture inspires end-users/employee's perception towards ERP adoption and influences the successful implementation of the system (Jones, et al., 2006). Enterprise resource planning (ERP) implementation is vividly associated with organizational culture, also organisational structure is valuable in comprehending successful ERP implementations (Ke & Wei, 2008). Therefore, as a result of the conceptions it can be said that organisation culture and structure may have a significant impact on ERP acceptance alongside its implementation in the context of Organisations in Nigeria.

### 3.4.3 Organisation Budget

The budgets of organisation or costs of system adoption are major determinant of an IT project implementation (Upadhyay, et al., 2011). ERP system implementation cost depends on the number of functionalities and extent of its customization. According to Rogers (2002), Considering SMEs, the adoption costs can range from \$15,000 per year for about 15 end-users on site licence. Also, it was reported that typical total cost of adoption for multi-national or large organisations can be up to \$2 million. The cost of complete ownership is greater than the

actual cost of the software (Upadhyay, et al., 2011). There are other ERP implementation expenditures such as customization or tailoring to suit your organisation's requirements during ERP systems implementation, alongside the prospective expenses with regards to waiting time to realise the return on investment (ROI).

Upgrade cost is another additional essential expenses related to ERP systems, this is because to remain effective and efficient, installed information technology (IT) systems needs continuous improvement, new functions regularly (Kapurubandara & and Lawson, 2016). Some of the top-rated vendors ready to use ERP solutions can be compared. According to "Apps Run the World" Albert, et al., (2019) there are two leading vendors SAP and Oracle, but IBM ERP solution has also gained huge recognition due to the company's reputation and consistent quality of their products. The table below represents a price comparison of the three vendors.

**Tab 3.2: ERP Price comparison (Diceus, 2019)**

Fees per/month per/user		Total Price	
SAP	\$150- \$220	SAP	\$25K- \$2M
Oracle	\$80- \$175	Oracle	\$15k- \$400k
IBM	From \$44	IBM	Form \$1000 per module

Therefore, as a result of the conceptions it can be said that organisation budget may have a significant impact on ERP acceptance alongside its implementation in the context of Organisations in Nigeria.

### 3.4.4 End-user Perception

The user's perception is one of the most important variables to be considered. ERP post-implementation requires more research considering the users, staffs, or employees usage view.

(Althonayan & Papazafeiropoulou, 2013) proclaimed that employee's performance is a clear representation of organizational performance. Therefore, studying the influence of ERP systems on its user's performance is a substantial means to assess how the system contributes to the efficiency and effectiveness of the entire organisation and the software performance. According to Chang, et al., (2008) they discovered that the satisfaction of the ERP users with the reliability, functionality, flexibility, and user friendliness features is essential for successful ERP implementation.

They also indicated that user satisfaction significantly impacts business improvement. The benefits and usability of ERP system affects the intention to use the ERP system. (Chang, et al., 2008) emphasised that social factors had the strongest influence on ERP technology usage. On the contrary (Chou, et al., 2014) claimed that effective usage of ERP system post-implementation was through knowledge gained from other users. (Chou, et al., 2014) also explained that employee's self-efficacy encourages users to share knowledge. According to Wu & Wang (2006) studies, user's training greatly impacts the user's perceptions of relevance of the ERP project to the organization and for their own job satisfaction.

The end user may include the execution team involved in the installation of ERP systems. The end user's involvement in the implementation process is important to the success of ERP system. The skills and knowledge of personnel involved is critical to the ERP systems. The execution team should be across various operation and departments. The end-user's perception is important because ERP systems itself brings an organisation-wide change that is perceived by many as a positive change towards entire organisational quality performance. End users of an ERP system are cut across the entire organisation and thus, their involvement is very crucial to upgrade their skills.

It is important to have identified every departmental requirement while adopting and finalising the ERP system implementation. According to Remus (2007) End-users can be classified into two categories: pre-implementation and post-implementation category. The pre-implementation end users are important during the requirements analysis phase, entire planning and installation phases, and as for the post-implementation end user's involvement is essential for acceptance and usage flow of the system. According to Upadhyay, et al., (2011) the end-user involvement and participation shows their attitudes and commitment towards the system implementation process.

Researchers such as (Upadhyay, et al., 2011) explained that lack of adequate information technology (IT) experience and knowledge in developing countries retard the adoption of ERP and leads to limited user participation if implemented. Researchers indicated the importance of constant review of ERP advantages in this situation in order to positively influence end-users perception of modern enterprise information technology, the actual benefits of installing ERP system should to be repeatedly clarified (Mishra, 2011). If the perceptions of the end-users are not well managed, they will not be enthused to assist with implementation process. They will not be able to support the experts or consultants that are willing to incorporate their skills and transfer knowledge to the end-users (Maditinos, et al., 2012). Consequently, because of the previously mentioned conceptions, it very well may be said that end-user involvement may likewise impact ERP acceptance alongside its implementation in the context of Organisations in Nigeria.

### **3.4.5 Business Process Reengineering (BPR)**

Project manager alongside the important team players establishes the formal procedures for the system flow of work, in terms of the processes in which the organisation uses to accomplish various tasks, and also the manner a business will run after the ERP system is in use. The

business process modelling is a complete and narrative representation of the way an organisation actualizes ERP systems to back their business operational activities. BPR is a design document that has important part in configuring the ERP system (Al-Mudimigh, et al., 2001). In the formation process of ERP systems, substantial amount of reengineering is done iteratively.

The essence thus is to obtain the advantage of the benchmarks given by ERP system. From this viewpoint, where and when conceivable, organisations tried to be set up to perceive standards and to model their major business processes as seen from those existing features in the system. According to Nah, et al., (2001), starting from the moment the ERP system is fully functional, organisation should continue to improve with reengineering by incorporating better ideas and continuous updates so as to entirely profit from ERP system's potential. Researchers says that software should be tailored and personalised (Nah, et al., 2001) to reduce the possibilities of inaccuracies.

It was also highlighted that Enterprise resource planning (ERP) can be said to be an exclusive case of IT adoption and implementation, where business process changes are immeasurably critical to the results of its adoption and implementation. Alternatively, (Law & Ngai, 2007) proclaim that it is of more advantage to make available an understanding of the methods that an organisations seek to adopt for establishing business process changes relative to ERP acceptance alongside its implementation. Therefore, as a result of the conceptions it can be said that BPR may have a significant impact on ERP acceptance alongside its implementation in the context of Organisations in Nigeria.

### **3.4.6 Change Management**

The restructuring of entire business process may include implementing the ERP or new system as part of radical change in an organisation. In such situation, Enterprise resource planning

(ERP) system adoption is considered as project of significant change. It requires proper change management, such project is managed in terms of radical transformation (D'Ortenzio, 2012). Managing change and its related conflicts is a priority of top management. The present characteristics and processes of an organisation before change may be incompatible with proposed change through ERP system. In order words, it will be beneficial to adopt ERP project alongside change management concepts (D'Ortenzio, 2012).

Hence, distinctive necessity for change to remain competitive is highly essential. Researchers emphasise that it is important to manage the changes taking place during ERP implementation (Saud Al- Schniederjans & and Yadav, 2013). Also reported by (Somers & Nelson, 2004) that change management is crucial IT implementation projects. The tenacious modification is valuable technique for establishing, administering modification in ERP implementing projects (Upadhyay *et al.*, 2011). Therefore, as a result of the conceptions it can be said that change management may have a significant impact on ERP acceptance alongside its implementation in the context of Organisations in Nigeria.

### **3.4.7 Vendor Partnership**

The concept of vendor selection and developing relationship with vendors is crucial. It is important for management to acknowledge the fact that vendors are more conversant and hold so much information about the system they supply. The vendors are able to offer various alternatives to an organisations as regards the customisation, features, time and cost saving procedures including functionality training all that pertains to ERP systems (Somers & Nelson, 2004). According to Albert, et al., (2019) they reported that the relationship between organisations and ERP vendors should be strategic, because the vendor's proficiency and technical knowhow can possibly intensify the chances of ERP project success, performance, efficiency and competitiveness.

(Remus, 2007) discussed how vendor partnership is essential during ERP systems selection and throughout implementation and very important post-implementation. The relationship between vendors and organisations may extend through the upgrades and the entire ERP systems lifecycle. Vendors are able to support various activities within the organisation which include technical assistance, training the end user or employees, maintenance and upgrades (Somers & Nelson, 2004). All these attributes of vendor make vendor partnership a crucial influence on ERP implementation success.

According to Albert, et al., (2019) organisations is required to be thoughtful in selecting vendors, because vendor's support is important to the ERP project success. The conceived theories therefore emphasise the fact that ERP project's success is definitely related to the system vendor partnership (Upadhyay, et al., 2011). Hence, as a result of the above-mentioned conceptions it can be said that vendor partnership may have a significant impact on ERP acceptance alongside its implementation in the context of Organisations in Nigeria.

### **3.5 Technology Factor**

The essential capacity of ERP systems is to give organizations the chance to integrate functions and people data creating an information discipline. It utilises enormous amount of activities and data attached with it into a single system with integrated information (Trimmer, et al., 2002). ERP is said to be one of the fastest growing technology services that creates competitive edge in terms of operational and technical brilliance. The coming of innovative advancements as far as DMBS (database management systems) from Organisations such as Microsoft, IBM, and Oracle and Peoplesoft, have acted as strong hold of encouragement for the use of ERP as an advanced technical system. In-depth of the technical reasons for using ERP boils down to many factors such as existing different unrelated systems, inadequate quality of data, non-integrated systems, outdated systems, non-scalable systems (Trimmer, et al., 2002). (King &

Burgess, 2006) Said ERP system is an advanced and innovative concept, and the system implementation can also be referred to as information system modernisation process.

### **3.5.1 Customisation Approach**

Customisation of software should be done early and not late to avoid errors. Alterations to the software ought to be evaded however much as could reasonably be expected to lessen blunders and to exploit easily newer versions of upgrade for the software (Rosario, 2000). There are various process modelling apparatuses which enhances business process customising in an organisations reducing amounts of software code alteration (Nah, et al., 2001). Accepting or rejecting the ideas concerning business processes invented within the system happens prior in the implementation procedure and all the more imperatively, impacts the size of customization required to the software and the organisations itself (Somers & Nelson, 2004).

Also other researchers claim that minimal customisation results in successful ERP implementation, in the other hand high level of customisation results in higher costs, increased implementation period, and lose of software maintenance and updates benefits (Raymond, et al., 2006). Customisation may or may not needed, because it certainly incurs more costs and time if required (Upadhyay, et al., 2011). Therefore, as a result of the can be said that customisation may also impact ERP acceptance alongside its implementation in the context of Organisations in Nigeria.

### **3.5.2 Qualified IT Skilled Support Staff**

In the literature there are features that the capacity of an individual staff that help in the implementation process of IT systems alongside their managers administrations is considered exceedingly important. In the instance, where the project manager is a member of the firm, they should possess in-depth knowledge both business and technical, and the capacity to convince with the management. Qualified staff should have the adequate experience and

sufficiently shrewd to interface effectively and engage the management, in order to ace the required technologies for the organisation (Poon & Wagner, 2001).

The usability and access to satisfactory equipment in the organization is a noteworthy reason towards the acceptance of new and innovative technologies. (Kamal, 2008) Indicates that the obtainable skill of the person is said to be a significant element that may have an effect towards the introducing new IT systems in an organisation. Considering a public organisations such where managements claims that their workers have no adequate training in utilizing IT and other words this insufficient training leads to resistance to change, and little or no use of IT solutions (D'Ortenzio, 2012). Lastly, technological advancement assesses the dimension of the executive's comprehension and backing for using IT to achieve an organizational strategic objectives (Chwelos, et al., 2001). Therefore, built on the notions, it implies that the level of IT understanding in staff will certainly affect ERP acceptance alongside its implementation in the context of Organisations in Nigeria.

### **3.5.3 IT Infrastructure**

Information technology (IT) infrastructure is an influential factor, these infrastructures includes computer systems hardware and software that is needed to develop, manage, and run IT applications. Accordingly, there is need to provide infrastructures such as hardware and network required for ERP systems implementation. An ERP system implementation relies on adequate IT infrastructure. Furthermore, software configuration has a significant influence on ERP implementation process (Doom, et al., 2010). In order to boost the possibility of ERP implementation success, organisations need to view ERP system as a complete integration project task, instead of a mere large-scale IT project only. Literatures such as including (Ross, et al., 2006) and (Doom, et al., 2010) concluded that IT infrastructure standardisation is an important success factor for all IT implementations. Therefore, based on the above-mentioned

notions, it implies that the standard of IT infrastructure may certainly affect ERP implementation in the context of Organisations in Nigeria.

### **3.5.4 Package Requirements and Selection**

Enterprise resource planning system is a consolidated set of packaged applications (Themistocleous, 2004). ERP vendors try as much as possible to build a universal system that fit into various organisations process easily, such that meets all the essential functionalities, but this is not always the case. For Instance, some packages are more suitable in context of large organisations, while some are best for small and medium organisations (SMEs). At the point of adoption, selecting an appropriate package should be the priority, thorough examination of the modules of the package that suit the organisational needs and functional requirements.

According to Akkermans & Helden (2002) they argued that any failure in the selection process, could negatively affect the organisation either by contradiction between package selected and processes, which could defeat the implementation purpose, or extreme customization of the most important characteristics of the software, which can be really time-consuming, expensive and never risk free. Selecting appropriate package from the inception stage requires thorough decisions process, considering the organisational budgets available to innovation, strategic goals or plan, time required and other prominent delivering tasks that will make the project a success.

(Remus, 2007) discussed the need for excessive effort in selecting the most appropriate ERP packages. Selecting suitable package is critical to the overall ERP implementation success. Usually, organisations choose a package that is relatively understandable, with enough scalability option, easy integration with business processes. All this needs cautious concentration (Upadhyay, et al., 2011). Therefore, based on the above-mentioned notions, it

implies that the meeting the organisation's Requirements and suitable package Selection may certainly affect ERP implementation in the context of Organisations in Nigeria.

### **3.5.5 System and information Quality**

According to Ifinedo & Nahar (2007) they reported that system quality is connected to challenges regarding the simplification of system operation and attaining knowledge of the system, the system reliability, data accuracy, consistency and efficiency. Information system (IS) quality have a wider perspective as compared to other studies within the Information technology (IT) sector. ERP system integrates the completely functional units of an organisation and it is considered as unified information system that high depends on the authenticity of the information in its database that cut across the entire organisation. Information Quality involves the quality of information obtainable from a system, it includes accurate information and its suitability for user's requirement, in timely manner and easy to understand.

Information quality can be reported in two types; i) the inherent data quality, that is precision or data accuracy and ii) logical quality meaning the essence of precise data in support of the organisation. Quality Information should be readily available, reliable, and relevant; Information that does not enhance organisational overall vision lacks quality. Literatures gathered report shows that information quality include relevance, easy to understand, important, timely and usable towards productivity (Ifinedo & Nahar, 2007). In the perspective of ERP systems, data quality is the information generated by the ERP system. Hence, the significance ERP system is reported to be capability to coordinate and manage the information flow in the organisation to ease decision-making process. Therefore, based on the above-mentioned notions, it implies that the system information quality may certainly affect ERP implementation success in the context of Organisations in Nigeria.

### 3.5.6 Training

The importance of training cannot be underrated toward a successful ERP system implementation in an organisation. Training have been reported severally in the literatures as a critical success factor in various implementation projects (Woo, 2007). According to Garcia-Sanchez & Perez-Bernal (2007) they reported that ERP implementation requires adequate training that will assist individuals to solve practical problems that may occur within the system. Furthermore, managements need to plan on beginning the training process at the early stage of the ERP projects to allow comprehensive understanding throughout the entire stages. Training should begin possibly before the implementation stage (Muscatello & Chen, 2008).

However, it is important that in no circumstance should the management underestimated the intensity of training crucial for ERP implementation and their associated costs. Nevertheless, Upadhyay *et al.*, (2011) discussed that an organisation's top management should be enthusiastic and keen to invest various resources such as money, time and other related resources on staffs training and all these resources should be in account as part of the ERP implementation cost. According to Upadhyay, et al., (2011) they also described the appropriate ERP adoption and implementation allocation budget for training is recommended to be between 10 and 15 %, these could increase the chances of ERP implementation success in the organisation to about 80 %. Therefore, based on the above-mentioned notions, it implies that adequate and early staff training may positively affect ERP implementation success in the context of Organisations in Nigeria.

### 3.6 Environmental (Process) Factor

Environmental factors including the government, regulatory bodies and competition in an environment are considered as the environmental factors. The literature has shown that the support of regulations in a country is an important factor towards innovations and adoption of

new technologies (Saeed, et al., 2012; Lechesa, et al., 2012; Appandairajan, et al., 2012). Researcher also indicated the importance of government policies and regulations as influencers that may affect the adoption of modern enterprise solution technologies. Including the developing countries (Amini, et al., 2014; Ellahi, et al., 2010) discussed that if a government has a clear commitment to modern technologies, it makes it a trend for organizations to adopt it.

A competitive environment is also believed to accelerate the adoption of new technology within organizations (Pudjianto, et al., 2011). Research in different literatures have discussed the influence of competitive pressure on technology adoption in an organization, which also applies to ERP adoption trend (Ruivo, et al., 2012). (Glowalla & Sunyaev, 2014) specified a direct connection between competitive pressure and ERP adoption trend among organisations. Therefore, based on the above-mentioned notions, it implies that environmental factors may positively affect ERP implementation success in the context of Organisations in Nigeria.

### **3.7 Enterprise Resource Planning Implementation Phases**

Considering the technical perspective of ERP projects and exploring relevant literature on “Information System” success model, the dependent variables that influences ERP implementation success in the three phases were described. The basis for adopting ERP is not to build a system from scratch but to integrate multiple incompatible applications (Khoumbati, et al., 2006). Accordingly, existing systems are combined with new systems, unified with a common database, the prominence is the integration. ERP projects bring organisational changes in terms process and workflow. These changes are said to be intense compared to the other IT projects. ERP project influences various systems, departments, staffs, and organisation entirely and it is important to consider its implementation phases.

### 3.7.1 Pre- Implementation Phase

The pre-implementation phase includes the selection and preparation stage. The Organisation (people) part of the framework includes the appointment of project board and team members. The project board commitments are to support the project decisions, facilitate the financial dispensation and provide other required resources. Also, project board are to communicate with the implementation team. They are in charge of appointing the main user's and system champion's roles and obligations for new systems. The project team comprises project manager, IT administrator, end-user representative, and vendor supervisory to manage the actual implementation. In the part of technology, the project board is also responsible to decide on suitable packages and modules. The project team should be actively involved in the data conversion, areas of software customisation and reporting type useful to various users.

The preparation stage within the organisation can be seen as identifying strategies, boosting enthusiasm to increase staffs understanding and IT skills for ERP project goals. The technological part, on the other hand looks into the existing technology infrastructure, to prepare the business's migration to the new IS system. Lastly, the project team will be identifying the main business processes and sub-processes structure. They assess current processes in order to identify the inflexible, modifiable and the that requires change. This is where the project scope is defined, outlined plan and costing provided.

### 3.7.2 Implementation Phase

The implementation phase is well integrated into the TOE framework and the three dimensions of change. The Organisation part is focused on system user's selection such as system administrators, and system champions. Continuous staff training and development alongside efficient project management. The appointed project manager makes plans, lead and communicate throughout the implementation process. Some of the elements in the environmental (process) phase is the process standardization and documentation, sub-

processes, and process assessment. In this phase, implementation of ERP modules, data migration and every other implementation process take place. In the later phase the system owners monitor the system for upgrade and also identify possible technological issues that requires changes or maintenance.

### **3.7.3 Post- Implementation Phase**

In this phase, there may be constant need for continuous improvement, detecting possible flaws. This will allow evaluation for system adoption against performance and towards future maintenance and possible upgrade. In this phase, precise data input is essential during review of documented processes and sub-processes for further updates of system performance. The process owner is in charge of managing and analysing processes and sub-processes. Part of the process phase involves that all updates, standards, and changes, should be clearly communicated to the stakeholders. And for the Organisation phase, the organisation should regularly assess user's satisfaction and training.

### **3.8 Gap in Literature**

Enterprise Resource Planning (ERP) benefits are enormous, but it is not apparent that ERP system implementation translates into increased productivity in Nigeria's manufacturing sector. Also, there are minimal studies on ERP adoption and implementation within the Nigeria manufacturing sector. However, the literature's common findings cannot be generalised and applied to Nigeria's manufacturing organisations, due to work, organisational structure, reporting system, decision-making process, and operational activities that may differ by country. The literature gathered on ERP adoption, and implementation are mostly regionally specific. Researchers discuss factors influencing ERP system adoption in their particular regions. Identified gaps from the literature review are listed below.

- ❖ The general theoretical models that explain ERP implementation in the literature may not necessarily satisfy ERP adoption and implementation in Nigeria's manufacturing sector.
- ❖ The body of knowledge on ERP implementation in Nigeria manufacturing sector is inadequate.
- ❖ There is little or no research that utilises both quantitative and qualitative research method to investigate the adoption of ERP within the Nigeria manufacturing sector.
- ❖ There is limited knowledge on the impact of ERP adoption within the NMOs in terms of productivity and organisational performance.
- ❖ There is no insight on how corruption practices hinders productivity and performance of the NMOs.

### **3.9 Conclusions**

In conclusion, the study proposed a conceptual model for studying ERP adoption and implementation within the Nigeria's manufacturing organisations. The model is based on the TOE framework in connection to the three dimensions of change (Heeks, 2002). The model is further expanded to discuss the factors influencing ERP adoption and its three implementation phases. The need change management is integrated and well emphasized. Balancing technological change requirements with process standardization and people skills was stressed as very important. The conceptual model presentation will hopefully help with the next chapter of this research. It will create clear knowledge towards the questionnaire. In the next chapter is the methodology and the approach for data collection and analysis.

## CHAPTER 4

### RESEARCH METHODS AND METHODOLOGY

#### 4.1 Introduction

Research methodology requires suitable approach and techniques to meet the study requirements and answer the research questions. This techniques are used to examine the research questions, analyse data and simplify social phenomena (Jogulu & Pansiri, 2011). Management research was previously focused on a single approach, which was either a quantitative or a qualitative methodology. Quantitative dichotomy is known to be more pronounced in management research and has been rationally accepted method for studying social and behavioural sciences since the twentieth century. However, qualitative research approach started to gain attention in the middle of late twentieth century as an alternative research approach to the conventional quantitative method.

The qualitative methods were concentrating on interpretive and narrative analysis of overall information collected via observation and communication, this approach provided an alternative to the quantitative approach with numerical information. In the past few years, management research has become rigorous and demanding which led to the triangulation of research methods. Hence, a third methodology known as mixed methods has begun to gain significant recognition among researchers due its effectiveness. According to Gorard & Taylor (2004) it is also called the third research paradigm and called the third methodological approach.

The mixed method is widely accepted, recognised, and preferred by management academics. This methods is regarded to be a thoroughly comprehensive technique for research in social sciences by integrating thematic and statistical data (Jogulu & Pansiri, 2011). Differently analysed and collated information, which is created by using differing data collection techniques, appear to achieve a greater depth in overall results. This leads to more precise evidence with increased reliability (Kumar, 2019). This chapter discussed the mixed method adopted and the justification for mixing the methods.

#### **4.1.1 Chapter Objective**

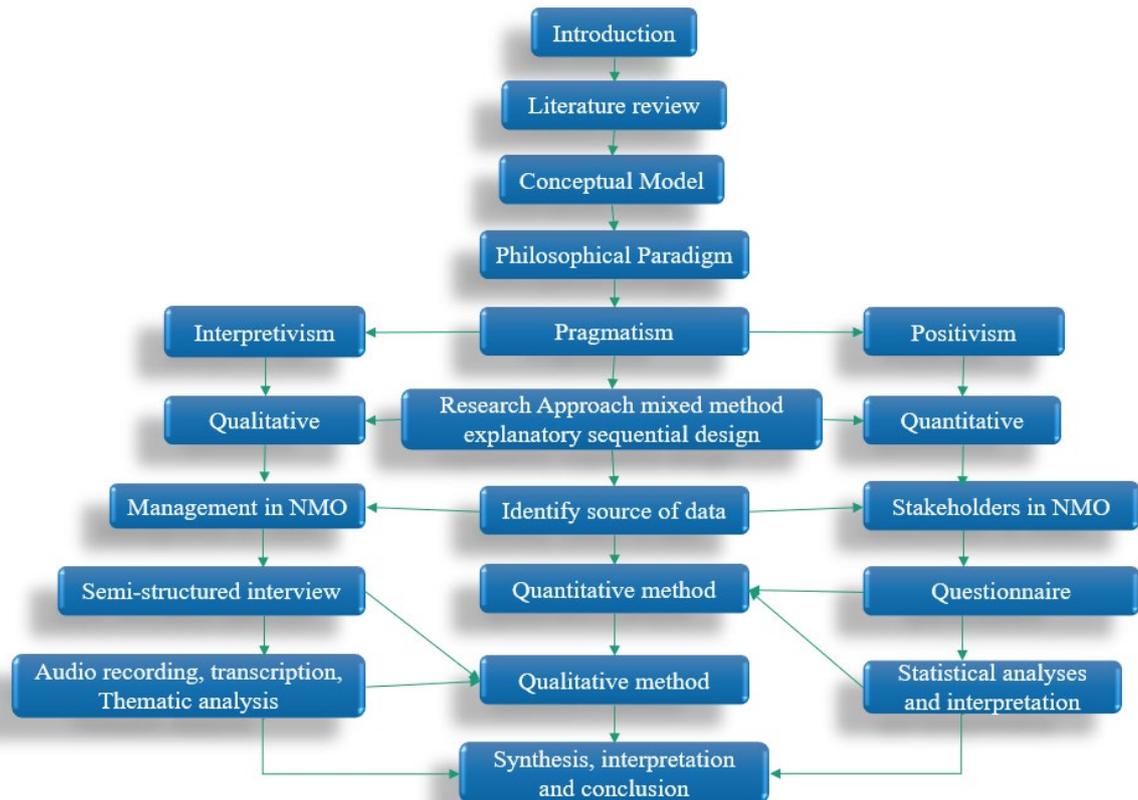
The objective of this chapter is to evaluate the method and methodology, that can be used to answer the research questions and assess the proposed conceptual model as described in the previous chapters. The chapter discussed “how” this study is approaching the research, “why” a method is chosen over others and “what” other method this research could have used. The chapter continues by discussing the research design selection and its justification. The rest of the chapter explains how mixed method selected is epistemologically coherent and useful for verification as well as for authentication of findings. This mixed method rigorously integrates statistical/numerical and thematic data to develop and improve the findings (Pansiri, 2009).

This thesis examines ERP adoption and implementation within the Nigeria manufacturing organisations by investigating the implementation of a redesign ERP system.

#### **4.1.2 The Research process**

This sub-section describes the research procedure of this study. The first stage of quantitative and qualitative data was collected between October 2016 and July 2017. The first step was the sampling process, followed by quantitative data collection. This is to identify and understand the critical success factors of ERP in Nigeria's manufacturing companies. This was then followed by qualitative data collection process. This involves face to face interview to gain in depth insight in the subject matter. The interview lasted an average of two (2) hours with each of the participants. Twenty-five (25) participants in the management position of various manufacturing companies were initially selected by data saturation was reached on fifteen (15) participants. However, second quantitative data collected in later chapter of this thesis, was the feedback after re-design, this is to measure the effectiveness of the solution employed by this research. This information is strictly used for the purpose of the research and none of the information of the research participants and the manufacturing organisations involved in this research was revealed.

The various steps taken during this research is described in Figure 4.1 below. In accordance with (Mackenzie & Knipe, 2006) the diagram shows the paradigm, methodology which include the data collection tools used in the research process. The research started by introducing the research, identify the research problem, detailing out the aims, objectives, and the research questions. Subsequently, reviewed literatures on ERP adoption and implementation in Nigeria and other countries. The key concept of this study are; "Economic and recovery plan (EGRP)" in Nigeria, "Nigeria Manufacturing Organisations (NMO)", "Management problems within the NMO" "ERP adoption determinants in NMOs", "Implementating a redesign ERP framework".



**Fig 4.1 Research process (Mackenzie & Knipe, 2006)**

### 4.1.3 Research Participant recruitment

The recruitment procedure includes classification of the participants according to their organisation's size, production category and geographical location. During the participants recruitment guideline development, care was taken to avoid sensitive words that could be easily misinterpreted to be intimidating, discriminating or and can be perceived unacceptable. Comment guidelines was used starting from the introductory message to the potential interviewee to the end of the interview. Some of which are listed below:

- ❖ Sensitivity to the social and cultural contexts from which participants is recruited.
- ❖ Researcher/interviewer is always reflecting and emphasising on the participant awareness and free-will participate in the interview or to answer any of the interview questions.

- ❖ Making sure Participants clearly understand what the study is about, what is expected of them during participation, and especially how their privacy will be respected?
- ❖ Non-intimidating, non-discriminating or unacceptable comments are completely avoided.

Participants was selected from manufacturing organisations located in the six (6) geographical locations in Nigeria. As represented in the participant’s recruitment procedure, geographical zones and states were presented in a table according to the level of security those regions. As a result of the use of physical one-to-one interview sections, there was strategic participant’s identification and people enrolment to take part in the research interview sections. The participants involve are mainly from the “save and accessible zone” few from the “unsafe but accessible zone” and non from the “dangerous and not accessible zone”. The participant selection criteria include manufacturing organisation staffs preferably but not necessarily of managerial capacity.

**Tab 4.1 Nigeria geographical zones and states (Abdulwali, 2019)**

<b>DANGEROUS AND NOT ACCESSIBLE ZONE</b>		<b>UNSAFE BUT ACCESSIBLE ZONE</b>		<b>RELATIVELY SAVE AND ACCESSIBLE ZONE</b>	
<b>North East</b>	<b>North West</b>	<b>North Central</b>	<b>South East</b>	<b>South South</b>	<b>South West</b>
Adamawa	Jigawa	Benue	Abia	Akwa Ibom	Ekiti
Bauchi	Kaduna	Kogi	Anambra	Bayelsa	Lagos
Borno	Kano	Kwara	Ebonyi	Cross- River	Ogun
Gombe	Katsina	Nasarawa	Enugu	Rivers	Ondo
Taraba	Kebbi	Niger	Imo	Delta	Osun
Yobe	Sokoto	Plateau		Edo	Oyo

	Zamfara	FCT			
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*Tab 4.2 Production Classification by production category (MAN, 2017)*

<b>Agriculture</b>	<b>Electrical and Electronics</b>	<b>Steel and Metal</b>
Agricultural Fertilizer	Dry Cell Battery	Foundry & Iron Rod
Agricultural Machineries	Electric bulbs, lamps, accessories	Galvanized Iron Steel
Agro Chemicals (Fertilizer, Insecticides and Pesticides)	Electric poles	Ingots and Ore
Agro-Allied Products	Electrical Power Control & Distribution Equipment	Metal Manufacturers and Fabricators
Animal Feed	Electronics	Metal Packaging Manufacturers
<b>Automobile</b>	Generators Assemblers & Accessories	Nails and Wires
Automobile Components	Gramophones Records & Musical Tapes Manufacturers	Primary Aluminium Producers
Bicycle Manufacturers	Mobile Phone and Computers	Steel Manufacturers & Fabricators
Motor vehicle & Miscellaneous Assembly	Refrigerator & Air-conditions/ Domestic Appliances	Steel Pipe Manufacturers
Motorcycle Assemblers	Cable & wire	Welding Electrode
Tire Rethreading	<b>Food, Drinks and Tobacco</b>	<b>Other products</b>
Tricycle manufacturers	Beer	Basic Industrial Chemicals
<b>Construction</b>	Biscuits & Bakery Products	Chemical & Stationery
Asphalt Manufacturers	Cocoa Chocolate, Sugar Confectionary	Leather Products Manufacturers
Cement Manufacturers	Dairy Product	Petroleum Products

Ceramics, Tiles and Marble	Distillery & Blending of Spirit	PVC Pipe
Fibre Cement Manufacturers	Fruit Juice and Drink	Resin Manufacturers
Plywood & Particle Board Manufacturers	Meat, Poultry and Fish	Rubber Products
<b>Domestics</b>	Rice	Pharmaceuticals
Bags and Suitcases Manufacturers	Sachet and Bottle Water	Industrial, Medical and Special Gases
Candle Manufacturers	Snacks and Confectionaries	Miscellaneous Machines & Equipment Manufacturers
Carpet, Leather, Rug Manufacturers	Soft Drinks and Carbonated water & wines	Ball point pen manufacturers
Cooking Appliance & LPG Stove	Starch & Other Miscellaneous Food products	Wood & Wood Products Including Metal Furniture
Cordage, Rope and Twine Manufacturers	Seasoning and Flavouring	Textile, wearing apparel
Domestic Ind Plastic Manufacturers	Sugar	
Enamel Ware	Tea, Coffee and other Beverages	
Foam Manufacturers	Tobacco	
Footwear Manufacturers	Vegetable and Edible Oil	
Glass Manufacturers	Flour and Grain Milling	
Nylon, Polythene and Sack Bags	<b>Print and Ink</b>	
Packaging	Industrial Printing & Printing Ink	
Safety Matches	Printing Ink	
Sanitary Towels, Napkins & Diapers	Printing Ink Manufacturer	

Soap & Detergent	Pulp, paper & Paper Products	
Toiletries and Cosmetics	Paints, Vanishes and Allied Products	
Toothpick	Printing & Publishing	

*Tab 4.3 Classification of Organisation size matrix (Bath, 2019)*

Size of Enterprise	Staff Thresholds	Turnover Thresholds
Large Enterprise	> 250	> £22.8m/\$22.8m
Medium Enterprise	50 – 250	> £5.6m/\$5.6m ≤ £22.8m/\$22.8m
Small Enterprise	10 -50	> £2m/\$2m ≤ £5.6 or \$6.5
Micro Enterprise	≤ 10	≤ £2m/\$2m

There are three common method for collecting data when conducting research, namely quantitative, qualitative, and mixed methods. A qualitative methodology uses techniques such as participants observations, focus groups and in-depth interview (Aigen, 2008). Quantitative research, in the other hand uses a scientific procedure to investigate a quantitative phenomenon by using mathematical models to test theories and hypotheses that relates to the area of study (Ang, et al., 2012). This research combines both qualitative and quantitative method, which is said to be the mixed method. The mixed method is used because it allows researchers to explore in-depth knowledge of the research area with multiple approaches to data collection and analysis in a single study.

This study utilized various data collection tools. Data was collected from various Nigeria's manufacturing firms using survey questions and interview, such that the proposed research questions can be answered, and the conceptual model validated. The research study was to investigate the implementation of a re-designed ERP adoption model in the Nigeria's

manufacturing Organisations. Considering an adoption model namely; “Technology Organisation Environment” Framework (TOE) using an explanatory sequential mixed methods design (Creswell & Plano, 2011). This research also chose its method according to the recommendations of academic books and journal articles relevant in the field of study (Jogulu & Pansiri, 2011).

#### **4.2 Research Philosophical Paradigm**

According to Mackenzie & Knipe (2006) they highlighted that, to establish a sense of direction, there is a need to ascertain philosophical beliefs that underpins a research study. Because researchers have different experiences, beliefs, and views within their environments. Therefore, they perform research in separate ways. Researchers are guided by their paradigms, their beliefs which can be theories or a set of principles that guide the way things are done. Identifying a paradigm at the start of a research is the basis for subsequent choices of research methodology and methods. The term research philosophy refers to the assumptions about what is been investigated and knowledge development around the data gathered, analysed and probably used “Gray, 2009” (Saunders, et al., 2009).

The knowledge development involves various types of beliefs and assumptions, these includes assumptions about human knowledge otherwise known as “epistemology”. Also, the existing realities encountered during the research is referred to as “ontology” and the researcher’s core value influence on the research process can be referred to as “axiological assumptions”. Therefore, selecting a research philosophy should be done as a primary direction, aligning element in the research design before commencing the actual research (Bell & Bryman, 2007). These various definitions suggest that a particular paradigm influences the conduct of a study. Therefore, to understand why and how this research approach, data collection and analysis method were chosen and applied.

It is imperative to first discuss the philosophical paradigm that suits the primary focus of this study. After this, the methodologies that were used will be discussed. In the context of social science research, pragmatic setting relates to their epistemological and ontological view. That means their understanding of the nature of knowledge and reality. The commonly used philosophical paradigm in social sciences include positivism, post-positivism, interpretivism, critical social theory, and pragmatism (Mackenzie & Knipe, 2006; Scotland, 2012). Mixed method used in this research was guided by pragmatic philosophy which combines methods from both positivism and interpretivism. The positivism implies an objective epistemology and believes in a stable reality, while interpretivism implies a subjective epistemology and the ontological belief in a socially constructed reality. Comprehensive overview of three philosophical assumptions will be discussed in the next paragraphs.

#### **4.2.1 Positivist or Positivism**

Positivism in social science is built on empirical evidence, respectively. This concept was initiated in the 19th century when metaphysical views was rejected by Auguste Comte, who emphasised that truth about reality should only scientifically derived (Mertens, 2007). The positivist paradigm is often referred as scientific research method. This paradigm was also supported by other philosophers such as, Francis Bacon, Aristotle, John Locke (Mertens, 2007). According to Creswell & Creswell (2017) who asserted that for outcomes to be real, they should be empirically observed and analysed. Positivism suggests method for investigating social phenomena and that “cause and effect” relationships can be explained (Mertens, 2007).

Positivism is said to be interested in testing theories, illustrating by observing and measuring events in order to predict and understand the world that exist around them. The positivism was replaced with post-positivist paradigm after the Second World War (Mertens, 2007). Post-positivists argued that existing theoretical frameworks are temporary, and it is to be tested by

new understanding. In other words, post-positivists suggest that reality is accessible to more than one interpretation. This somehow supports the “constructivists” view. Things are often seen from various perspectives by people, "what might be the truth for one person or group of persons may not be the truth for another person or group" (O'Leary, 2004) Largely, it is important to note that positivist and/or post-positivist research paradigms associate with quantitative methods of data collection and analysis.

#### 4.2.2 Interpretive or Interpretivism

Interpretivism is derived from two philosophies- phenomenology and hermeneutics by Edmund Husserl, Wilhelm Dilthey, and other German philosophers. This paradigm criticized the application of positivism in the social sciences. The criticism was tagged with terms like ‘anti-positivist’ or ‘anti-naturalists’ when referring to interpretivist research paradigm. The argument remains that there is a major difference between the subject matters of the nature and social sciences (Blackstone, 2012). The interpretivists claim that the study of social experiences entails insight into the social world that people have constructed around themselves. However, it is important to note that people are evolving and they constantly re-interpreting their world (Blaikie, 2007).

Interpretivist claim that identifying social situations, people’s actions, personal actions, nature and human created objects are parts of the world around us (Blaikie, 2007). It was noted that Interpretivists approach aims to understanding people’s experiences, which also suggests that "reality is socially constructed" (Mertens, 2007). Hence, Interpretivisms relies on participants views or experience of the phenomenon under studied. This can include relating the participant’s background and its influence on their personal experiences on the findings of a particular study (Creswell, 2013). In contrary to post-positivists, Interpretivists does not start their investigation with a theory, rather they generate or inductively develop a pattern of

meanings “Theory” (Creswell, 2013). Interpretivists mostly depend on qualitative methods of data collection and analysis.

### 4.2.3 Pragmatism

This philosophy is not dedicated to any particular philosophical system or reality. The paradigm argues that, the scientific notion about accessing “truth” by social inquiry of the real world using a single scientific method is not enough (Mertens, 2007). Pragmatism focuses on ‘what’ the research question is and ‘how’ it can be answered (Creswell, 2013). In this sense, the researchers do not have to use a specific research method. The term pragmatism was founded in the late 19<sup>th</sup> century by an American philosopher named “Charles Sanders Peirce” and the word was derived from the Greek word ‘pragma’ meaning action. The knowledge was advanced by other academics such as Arthur Bentley, John Dewey, George Mead and William James. (Ormerod, 2006; Creswell & Plano, 2011).

Although, the individual impact of these philosophers cannot be fully explained in this study. However, it is important to know that, their believe was “in other to understand the real world, there is a need to improve the world and understand the experiences of the inhabitants (Ormerod, 2006). Charles Sanders Peirce explained that “beliefs are guides to actions and should be judged against the outcomes rather than abstract principles” (Ormerod, 2006). However, the pragmatic philosophical contribution of “George Mead” was more widely recognised because earlier on, in the time (1857-1866) the views of “Charles Sanders Peirce” were not so popular. Mead ignited an idea known as ‘the act’ also called ‘presentism’ which he used in charactering reality.

Presentism suggests that for a phenomenon to be real, it must be happening in present. Dewey also contributed immensely to knowledge pragmatism, philosophical process, naturalism, and contextualism. He is known as one of the prominent philosophers of the 20th century (Creswell,

2013). Dewey believed in complete integration of skills and knowledge, a concept from his belief in pragmatism which can also be referred to as learning by doing (Ormerod, 2006). Dewey's pragmatic approach to religion and ethics are considered to be most renowned of his entire contributions to knowledge (Haggbloom, et al., 2002).

Increased studies have driven a new way of thinking about this pragmatic belief and its philosophical role in science and life. Pragmatism is well known for political and religious statements in this current era, but it is also a philosophy and method of conducting research. (Ormerod, 2006). It is explicit that all research should be underpinned by one or more philosophical paradigm that will be adopted by the researcher (Creswell & Plano, 2011). According to Creswell (2013) in a table titled, "Interpretive Frameworks and Associated Philosophical beliefs" can be found in pages 36-37, shows a clear picture about the uniqueness of pragmatism research paradigm within the social sciences. Pragmatism is quite a unique and distinct philosophical belief, unlike other paradigms.

Pragmatists believe so much in the research question and the way it has been answered and this is more important than the methods used in research. Also, it believes that multiple methods can be used in data collection, considering the relevance to the research questions (Creswell & Plano, 2011). Because reality can be singular or multiple in nature, pragmatists support combining inductive and deductive approaches in order to present various views of reality (Creswell and Clark, 2011). Epistemologically, the most important consideration in the pragmatic tradition is practicality. When addressing research problems pragmatists ask themselves what method(s) works for that specific problem. This is unlike the traditional scientific methods, mainly underpinned by positivism, where researchers are restricted to collecting data objectively (Creswell and Clark, 2011).

Pragmatism allows researchers to realise that there can be one or more (mixed) methods of inquiry into a research question (Brandom, 2011). According to Creswell & Plano (2011) supported the views by justifying the need for modern researchers to apply mixed or multiple approaches to research in social science. They stated that the most essential consideration in a research should be the suitability of the adopted approach to address a research question. The suitable paradigm for this approach is pragmatism because it allows research projects to be performed without limitations by a set of rules peculiar to one paradigm. Pragmatism is therefore unique because it operates as a gateway to the process of researching a wide-range of problems in the most practical manner.

#### **4.2.4 Frequently used research paradigm in ERP Implementations.**

According to the literature, researchers commonly use quantitative, qualitative, and mixed methods in ERP implementation studies. Each of the method strengths and weaknesses have also been outlined by researchers. Quantitative studies have been used severally ranging from causal-comparative designs to correlational designs (Ravasan & Mansouri, 2016; Bansal & Agarwal, 2015). However, surveys frequently referenced quantitative approach in reviewing ERP adoption and implementation studies (Bansal & Agarwal, 2015; Pishdad, et al., 2014). Surveys mostly utilizes the Likert-scale type of measure for measuring patterns, attitudes, participant opinions and so on (Costa, et al., 2016; Garg & Agarwal, 2014).

According to Gajic, et al., (2014) quantitative studies on ERP system implementation and their impact on business performance are not sufficient enough. Moreover, the economic benefits of ERP system are difficult to measure by quantitative analysis. Literature shows that research seeking for in-depth information from practitioners and experts in ERP implementation success/failure factors used qualitative interviews, case studies and phenomenological design (Abdelmoniem, 2016; Alharthi, et al., 2017; Saade & Nijher, 2016). It was noticed that mixed

research method was less cited in ERP implementation research in comparison with both qualitative and quantitative research method. However, mixed method can be very effective, because one method can be used to inform the other (Fetters, et al., 2013). The snag to the mixed method is that it is more time consuming.

#### **4.2.5 Justification for choosing pragmatic paradigm**

The paradigms underpinning quantitative and qualitative research approaches are the positivism and interpretivism, respectively. They both possess strengths and limitations in such a way that either of them cannot be considered to be better than the other. Therefore, the argument is, there is no one best paradigm and research approach to advancing knowledge. This is because prioritizing or choosing one approach over another will always constrain the ability to move beyond its boundaries. The early recognition of this argument about quantitative and qualitative approaches to research and trying to understand it, potentially allows experienced researchers to create unique means of answering their research questions.

Research approaches is identified as the main component of research because it defines the procedures for the research and steps involved in it, from broad assumptions to specifics of data collection, interpretation and analysis (Creswell & Creswell, 2017). The research approach also helps researchers to identify the actual research design and the field work processes, respectively. The philosophical assumptions of the researcher impact the decision of research approach to the study, which includes the research design, data collection method, analysis, and interpretation. This is the means the researchers select to study the theory involved within research frame (Scotland, 2012). Selecting mixed method approach in this research is based on the nature of the research problem under study, personal experience, and the study audience.

Mixed methods approach is connected to two essential concerns; the first is the capacity for mixed methods to benefit a variety of research discipline in management and Secondly, the

questions and the extent to which they determine the research approach (Saunders, et al., 2009). Hence to ensure reliability and validity of this research findings the researchers decided to make a rational justification for choosing the mixed method. This research seeks inductive and deductive reasoning from data analysis, this research logic possesses a great strength and mixed method supports the use of both. This allows equal perceptions from theory generation view and hypothesis testing significance in a single study without any compromise.

The combined deductive and inductive perspectives enable the researcher to extract a better inference from the research study. Also, it was important for this research to adopt a more sophisticated research designs with a multiple data collection design, and analysis that can possibly provide different/supporting views and findings (Jogulu & Pansiri, 2011). Furthermore, because mixed methods amalgamate statistical and thematic analysis, combining and comparing multiple data sources, processing, and analysing, which can be referred to as triangulation. Triangulation justifies the selection of mixed method in this research, due to its ability to strengthen the research findings and, as a result of multiple techniques adopted to tackle the research problem substantial inferences we made.

In this research context, mixed methods display suitability with its complementary strengths and no obvious weaknesses. Undertaking mixed method eradicate weakness in single research approach, because data generated via survey questionnaire are not likely to capture the personal views and experiences in social settings, the use of mixed approach avoids such occurrence. In addition, mixed methods, reduces dependence on statistical data solely to explain a social occurrence which are more subjective in nature. The validity and reliability are predominantly are derived from the meaningful detailed insights accumulated by the subjective interpretations of experiences, supported by the varied source data collation that creates reasonable answers to the research questions.

The constancy in the survey collated views of participants in relation to the research questions, which are statistically described in questionnaires, corresponded with the subjective interpretations of those experiences in interviews. Hence, mixing the data collection techniques only improve the discoveries enabling robust inferences with assurance. According to Pansiri (2009) that argued, by indicating that majority of the research in management encourages the belief that solely scientific approach is not most appropriate to understanding organisational life. Both approaches have been used in combination to exhaustively tackle research problems (Creswell & Plano, 2011).

As earlier identified, pragmatic researcher focuses on the research questions. Hence, they combine paradigms, approaches, and methods to collect and analysis data to comprehensively understand the problem. The participants' views were adequately collected, analysed, and interpreted. The means of exploring these within the pragmatic paradigm is the use of a mixed methods sequential exploratory design.

**Tab 4.4: Differences in the five major Research Philosophies (Žukauskas, et al., 2018)**

Ontology (Reality)	Epistemology (What is believed to be real)	Axiology (Values)	Methods
<b>Positivist or Positivism</b>			
A True reality, Real, external, Independent, Universal	Pre-conceived law like scientific theories; Testing and proving theories comprising variables and hypotheses; Researcher takes the role of an observer; Attempts to increase the predictive understanding of the phenomena; Usual for laboratory experiments –forecasting – simulation.	Researcher is detached form research, Value-free that is neutral and not influencing what is researched by maintaining an objective attitude	Quantitative methods of analysis, deductive, structured, large samples, measurement, analysing a range of data.
<b>Critical or Critical realism</b>			

<p>The actual and the real External, independent Objective structures.</p>	<p>Social reality is historically constituted; Social reality is produced and reproduced by people; Social – cultural and political conditions influence ability of people to act; Main task as a social critique to understand restrictive and alienating conditions.</p>	<p>Researcher acknowledges preference by world views as objective as possible, cultural experience and upbringing. Researcher tries to reduce partiality and errors.</p>	<p>Intensive historically established analysis of Structures. Range of methods and data types to suit subject matter.</p>
<b>Interpretive or Interpretivism</b>			
<p>Socially constructed Through culture. Multiple meanings,  Interpretations of realities. Experiences and practices</p>	<p>No preconceived theories. Knowledge of reality is gained through only social constructions. Signifies the complexity of human sense as situation changes; Researcher participates in the empirical study; Usual for subjective review – debates – descriptive interpretations.</p>	<p>Researchers add value as they are part of what is researched, Researcher Explanations are reflexive and key to knowledge contribution.</p>	<p>Qualitative methods of analysis, inductive with small samples, intensive, investigations, and a variety of data can be analysed</p>
<b>Pragmatism</b>			
<p>Reality is the practical Consequences of ideas experiences and practices.</p>	<p>Practical significance of knowledge in detailed Contexts. True concepts and knowledge are those that allow successful Action Concentrate on Problem solving.</p>	<p>Value initiated research sustained by researcher's doubts and beliefs and it is Value-driven.</p>	<p>Range of methods is mixed, such as the qualitative, quantitative, action research it is strongly recommended due to research problem and research question. Hence, emphases are on practical solutions outcomes</p>
<b>Postmodernism</b>			

Socially constructed, Interpretations and realities are	Truth and Knowledge is determined by dominating ideologies and challenging of dominant views as Contribution. Exposure of power relations	Value-embedded Research. Some research narrative views are suppressed and silenced at the expense of others.	Typically, qualitative methods of analysis are used reading texts and realities against Themselves In-depth investigations.
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### 4.3 Research methodology

Research methodology is the science of studying and understanding how research should be done systematically. Also, it involves the study of various steps and design that can be relatively adopted by the researcher, focusing on the research problems and logic behind the problem. The complete framework from the philosophical assumptions and methods chosen to conduct research. Hence, methodology is a means to approach a research problem systematically and meticulously, to achieve a valid and reliable finding and therefore presenting a credible conclusion. This purpose of the chapter is to tell the reader the step by step of the process used to collect the data necessary to drive this research aim and answer the questions.

The decision made on the choice of method, design, sampling, and the procedures followed is supported and justified by the objectives that this research is set to achieve. The common methodological choice mostly adopted by researchers is grounded on the distinction between qualitative and quantitative data. Qualitative data is in form of descriptions based on words or images, while quantitative is in a numerical form. The research methodology can be called the spine of the research because it determines the research direction such as, manner for data collection and the analytical tools that would be used for deriving conclusions from the data (Kumar, 2019). A suitable research methodology is very helpful to the research.

Hence, a researcher should be diligent choice, because it could be quite difficult. It should be done based on the researcher's beliefs, views, and interest (Ang, et al., 2012). Factors involved in choosing a research methodology include the research aim, epistemological concerns and norms of practice in this topic area and other previous work (Buchanan & Bryman, 2007). Methodology denotes to the philosophical norms to specific methods, while methods are the exact techniques of collecting data (Blackstone, 2012). On the other hand, (Mackenzie & Knipe, 2006) argued that methodology is the proposed design connected to the theoretical framework to be used in the research and also a systematic procedures or tools adopted to collect and analyse data. The following steps was following in this research to select the methodology.

- ❖ Clear definition of the research aims objectives and questions.
- ❖ Review of previous studies to identify the most effectively used methodology in the research area.
- ❖ Understanding the duration and skills needed that would enable the research design to be utilize effectively.
- ❖ Detailed documentation of the entire methodological approach and review.

**Tab 4.5 Methodology verse method (Mackey & Gass, 2015)**

Research Methodology	Research Method
➤ Research methodology aims at understanding and using the correct procedures to find credible answers to research questions.	➤ Research method aims at discovering the answers to research questions.
➤ Research methodology involves the analysis and learning of the different techniques that can be used in carrying	➤ Research method involves conducting experiments, administering surveys and interviews.

out a research such as conducting experiments, administering surveys and interviews.	
➤ Research methodology breakdown the method which may be used to proceed with the research.	➤ Research method are processes through which research is conducted in a specific subject area.

### 4.3.1 Quantitative research methodology

This is a variable oriented approach which can be used testing theories, collating empirical evidence by examining the relationships among variable (Blackstone, 2012) Hence, data collected can be numerically measured via typical survey instrument, to enable statistical analysis procedure. The data collection methods are indicated below.

- ❖ **Survey**: Collects numeric description of trends, opinion and attitudes of a sample representing an entire population. The survey research includes both cross-sectional and longitudinal studies with the use of questionnaire or structured interviews to collect data (Creswell, et al., 2017). This type of research generally involves collecting a large amount of data. This study utilized quantitative method as part of the research design, having a set of closed survey questions which are straight-forward for the participants to answer. The study received considerable high responses rate due of the simplicity and clarity.
- ❖ Quantitative method is commonly used for all kinds of research in the world. Before the emergence of improved technologies, surveys were carried out face to face with the participants and recorded by the researcher (Paradis, et al., 2016). However, technology mediums such as emails, or social media have changed how data is collected.
- ❖ **Experimental research**: This requires an experiment set up for hypothesis to be tested by making a condition where one or more variables are manipulated to check cause and effect. Test is done to examine the effects on dependent variable if the independent

variable is removed or altered. This method usually experiments on suggested hypothesis, analyse and reporting the findings to understand if the hypothesis is supporting the theory or not. An example of an experiment conducted by a manufacturing organisation, who are trying to understand the reason they were unable to capture the market. They made some changes in the processes in each of their functional unit such as manufacturing, marketing, sales, and operations. The outcome reflects that sales training has a direct impact on the market coverage for their product.

#### **4.3.2 Qualitative research methodology**

Qualitative research methodology expatiates on inquiries that may not be answered by quantitative approach (Ang, et al., 2012). Qualitative research paradigm, focus is to accurately capture the experiences and perceptions of participants in the phenomenon under study. It is very useful for finding important initial insights about an investigation compared to quantitative surveys. According to Creswell, et al., (2017) the exploratory qualitative research assist researchers to collate a substantial information as regards research problem especially when limited information is available. Qualitative method relies on text and images, utilized by the researchers, in quest to interpret a meaning to the way people behave and to develop an understanding of social concepts.

The main benefit of this method is its ability to produce rich and deep data, (Jebreen, 2012) listed the advantages of using qualitative research methods below, which relates to those earlier address such as:

- ❖ Enhance the detail to existing information about a phenomenon obtained from initial quantitative study
- ❖ Create clearer understanding of a topic by studying it concurrently using other methods.
- ❖ Be used to explore into fresh area that has not been researched before.

- ❖ Assist with understanding complex situations that can't be approached quantitatively.

There are research questions that requires to be qualitatively analysed, as quantitative methods are not suitable in such case. Severally, detailed information is needed in a research when it is crucial to thoroughly observe a specific audience behaviour and the results better expressed in a descriptive format. Qualitatively analysed data more descriptive rather than predictive. It allows the research to construct or back theories towards future potential extended research. It can also be used to derive a conclusion supporting the hypothesis under study. In qualitative method, data can be collected via.

1) **Case study**: Case study is utilized to evaluate information by analysing existing cases. This data collection method is frequently used in business research to gather empirical evidence for examination purpose. Case studies investigate a problem within its real-life context. It involves careful analysis of the parameter and variables in the case study to make sure they are the same as the case that is being studied. Using the case study findings, relevant conclusions can be reached concerning the case that is being investigated.

2) **Observational method**: The process involves observing and gathering data from target setting. This method is quite time consuming and can be relatively very personal. The observational method can be classified as a part of ethnographic research, used to gather empirical evidence. This is frequently a qualitative research, though sometimes it can be quantitative depending on what is being studied. For Instance, a study to observe an animal in the forests. This research typically take time because observation must be done for a specific amount of time to comprehensively study patterns or behaviour of such animal. This type of observation can also be extended people shopping in a mall to identify their buying behaviour and pattern.

3) **One-on-one interview**: The one on one interview is used in this research; this method is completely qualitative, and it is one of the most widely adopted. This form of data collection method aids precise meaningful information, provided the researcher ask the right questions. It can also be referred to as a conversational method where detailed data can be collected depending on the direction the conversation leads.

4) **Focus groups**: The focus group is used when the researcher seeks answers to what, why and how questions. It usually requires small group under study and researcher does not necessarily have to interact with the group in person. Moderator is usually needed where the group is being addressed in person. The focus group is widely adopted by various production companies to collect data about their brands and the product.

#### 4.4 Research Methods

Research methods can be simply defined as data collection and analysis procedure. The research method planning involves decision if to gather “Primary data or Secondary data or both”, “ Qualitative approach or Quantitative approach or Mixed”. All these are dependent on what type of data needed to answer the research question. Methods are the approaches that are used to conduct a research, it specifically refers to the techniques used to answer the research questions. These include the instrument used in the data collection and analysis stage of the research activity, such as making observations, recording data, processing the data, making inferences, and reflecting on the implications and findings. Qualitative approach is better-off, and its conception is usually based on subjective and interpretivist perspective.

Although, qualitative research enhances in-depth understanding of the study but due to time limitations, it usually involves a few samples of participants. The findings are hereby restricted to the sample studied and therefore cannot be generalised to the entire population. The gathering of qualitative data includes conducting semi-structured or unstructured interviews,

participant observations and document analysis. Analysing qualitative data can be said to be time consuming in comparison with the quantitative analysis data. Considering quantitative data on the other hand, data collection and analyses might be relatively easier to conduct even though it involves a large sample of participants. Quantitative data are collected in such a manner that it can be measured objectively with numbers.

Numerical data comparisons and statistical analysis is done quantitatively because this method is more scientific presenting a clear and justified answer and such answers may appeal to people with research questions. Analysing quantitative data can also be quick due to the use of data interpretation software such as “SPSS”. The research sample in this case can involve many participants which allows generalisation to the wider population. There are many organisations that keeps various statistical records which can be referred as data, also quantitative data can be obtain based questionnaires among other methods. Choice a research methodology typically depends on research questions, consequently informed by the research aims and objectives.

Consequently, unstructured, or semi-structured interviews are used to obtain qualitative data, while questionnaires can be used to collect quantitative data. This is mostly applicable but sometimes qualitative data/words can often be translated into numbers. An instance is, reporting the frequency of a specific words. In other words, questionnaires produce quantitative as well as it can also produce qualitative data. An instance is a multiple-choice question producing quantitative data, while open questions can produce qualitative data. Both approach research can be put into three categories which include.

#### **4.4.1 Data Collection methods**

This is referred to the relevant instrument and/or procedures useful in research to obtain and analyse data (Cummings, et al., 2013). According to Creswell & Plano (2011) they indicated that the method of data collection and analyses is a substantial aspect of every research process.

They also continued that it is more than just a simple technique for collecting data. Individual researcher's choice of data collection method is justified by their knowledge of specific findings of the research (Creswell & Plano, 2011). Quantitative phase of this research utilized a questionnaire survey.

The choice is informed by the knowledge of this research findings by addressing the research questions such as the level of awareness/experience of ERP in Nigeria's manufacturing organisations and investigating the factors affecting the adoption and implementation of ERP. The research finding to be measured is clear. The meaning of measurement also requires clarification. According to Cummings, et al., (2013), the instrument of measurement is better drawn from the wealth of knowledge of similar research in this jurisdiction. Validated questionnaires were broadly used by to obtain participants response about the findings of this research.

The process of collating measurable information on variables of interest, through a systematic method that enables one to answer research question, test hypotheses, queries and evaluate possible results is known as data collection. There are several reasons for collecting data, in this study data collection focus primarily on manufacturing, production and enterprise management. Before going deep into different data collection methods, the difference between the two main types of data is identified (quantitative and qualitative) as they are both mixed in this research. A brief explanation of the instruments and procedures that was adopted to collect useful data in this study are discussed in the sections below.

#### **4.4.2 Data collection tools (Quantitative and Qualitative)**

Quantitative research method is said to be about numbers and there is need to measure variables. Therefore, measuring instruments will be required with relevant scale types. A measurement instrument is any tool that can be used to collect consistent data from every

member of the target population sample that is consistent question is designed to be ask each participant in the same way. Measuring instrument can be in various form, an example of measuring instrument is the “**Questionnaire**” which is used in this research. Questionnaire is referred to as specific formats that can be used to ask questions. Also, it is important to note that all questionnaires can be referred to as a measuring instrument, but some measuring instruments are not questionnaires.

Questionnaire survey is widely used in various research where there is need to gather a substantial amount of data from many participants. The modern way of distributing survey questionnaire enables easy, widespread, and cheap means of reaching out to the participants with automated collation and analysis of the data collected. As much as developing questions appear simple, the construction of credible questionnaire that strictly address and answer the research question may be difficult. Questionnaire must be precise, less intrusive, and straightforward enough for the participants to understand. Hence, for these reasons there may be needed to thoroughly validate questions. The chosen sample size should represent the entire population of study and sometimes survey can be administered to the entire population of study. For instance, instead of random choosing a sample size in an organisation, the questionnaire survey can be administered to the whole organisation of study.

These are series of questions used towards the collection of written or verbal responses from research participants. They are in essence data collection tool allocated to interested individuals for collecting relevant information towards the research question (Cummings, et al., 2013). Several authors have specifically attributed questionnaires to a quantitative study approach due to its distinctive and fundamental features such as (a) Questionnaires are structured leaving the participants with multiple answer options to choose from. (b) Questionnaires are pre-designed

in line with the research question. (c) Questionnaires follow a standard format, i.e. the same question in the same order for all participants.

Hence, Questionnaires can also be used as a tool in qualitative studies but they have to be designed with open-ended questions (Cummings, et al., 2013). There are reasons behind the choice of questionnaires as a tool in this study. First, is drawing the instrument of measurement from similar research jurisdiction. In other words, they are increasingly used in series of management research. Secondly, studies have established validated question to support outcomes relevant to this study. Lastly, the use of questionnaire is typically quick, cheap and confidential protecting personal data of participants.

Questionnaire allows collection of large amounts of data from various participants. (Teddlie & Tashakkori, 2011). Although one of the negative aspects associated with questionnaires is that it hinders participants from providing detailed and clear answers. Also, questionnaire does not allow the gesture of the participant to be read. Hence, due the nature of survey questionnaire, it does not instant inquiry into the answers provided by the participant. For quantitative study questionnaire design, there is a simple rule of thumb regarding the nature of the questionnaire. According to Cohen, et al., (2013) they suggested that the size of the sample, determines extent structure, closed and numerical the questionnaire may have to be.

That is the smaller the size of the sample, the less structured, open word-based the questionnaire will be. However, strictly structured, closed-end questionnaire is effective in this study with large samples due to generating frequencies of response for statistical analysis. In this study, two (2) questionnaires were administered for data collection. Investigative and feedback questionnaire. Brief description, definitions and abbreviations was explained at the top of the questionnaire alongside the consent and data protection awareness is to be read before

attempting to answer the research survey to ensure that they the participants have a clear understanding of what is required of them and the information required for the survey.

The type of measuring instrument or tool that is frequently used in a qualitative survey includes observations and interviews and the methodological tool used in this method is interpretation. This research used “**interview**” as the data collection instrument. Hence, narrative method is used to enhance the interpretation and understanding of the area under study. This method of data collection is used to interpret data that are their meaning is established and expressed through words this type of information cannot be numerically quantified.

Qualitative interviews are presented in various forms which are widely used during data collection they are structured, unstructured, and semi-structured. Interviews allow the researcher to gain access to rich and credible information. This method of data collection requires comprehensive planning in the development of the interview structure, whom to interview, how many participants, interview duration, whether to conduct a group or individual interview and how it will be recorded and analysed. Interviews are time consuming; they are also susceptible to biases which can be significantly minimised during the design stage. Unlike the skills required for an interviewer, only few skills are needed for the interviewee, which include listening and communication.

#### **4.4.3 Data Analysis Methods**

As proposed by (Creswell & Plano, 2011), analysis in a usually blended mixed method study includes a separate analysis of quantitative and qualitative data utilizing techniques suitable to each of the methods. The way to deal with information investigation or data analysis in a blended/mixed method study relies upon the embraced design approach. Since this research is a mixed method sequential explanatory design. A successive approach to data analysis was used. Where quantitative and qualitative were analysed independently followed by a

combination of the findings (Creswell & Creswell, 2017). As a result of the sequential approach allowing quantitative data analysis to strengthen the next qualitative information collection and its analysis. The significant objective was to give a thorough comprehension of the research questions. This way to deal with information investigation underscores the criticalness of both phases of analysis, which are subject to one another and on a very basic level added to the accomplishment of this mixed method study.

This is concerned with the data analysis i.e. establishing findings, identifying patterns, and establishing relationships between variables. The data analysis method is determined by the type of data collected. It is possible to analyse data quantitative and qualitatively. Survey data can be used as an example, where responses can be analysed by “meanings” qualitatively and by “frequency” quantitatively. Qualitative data analysis method deals with the understanding of words, ideas, and perceptions. The qualitative method can be used to analyse data collected via an open-ended survey, interview responses, literature reviews, case studies scenarios and other text sources rather than numbers. Qualitative analysis method is quite adaptable and depend on the researcher’s assessment. Therefore, there is a need to reflect carefully on your selections and conclusions (Scribbr, 2019).

Quantitative analysis methods involve statistics form numbers to evaluate frequencies, averages and descriptive correlations between variables and can also be cause-and-effect relationships in terms of experiments. The quantitative method can be used to interpret data that was collected gathered from experiments and data from a probability sampling. The value and validity of data statistically analysed makes it possible for quantitative analysis result to be standardized and repeatable among academics (Scribbr, 2019).

**Tab 4.6 Research data analysis methods (Scribbr, 2019)**

Research analysis method	Qualitative or quantitative?	Purpose of use
Statistical analysis	Quantitative	Statistical data such as via experiments, surveys, and observations.
Meta-analysis	Quantitative	To analyse the results of a large statistical data.
Thematic analysis	Qualitative	The analysis of data collected via interviews, textual or focus group sources.
Content analysis	Either	The purpose is to analyse large volumes data gathered from textual or visual data, surveys, literature reviews, or other relevant sources.

#### 4.4.4 Validity and reliability

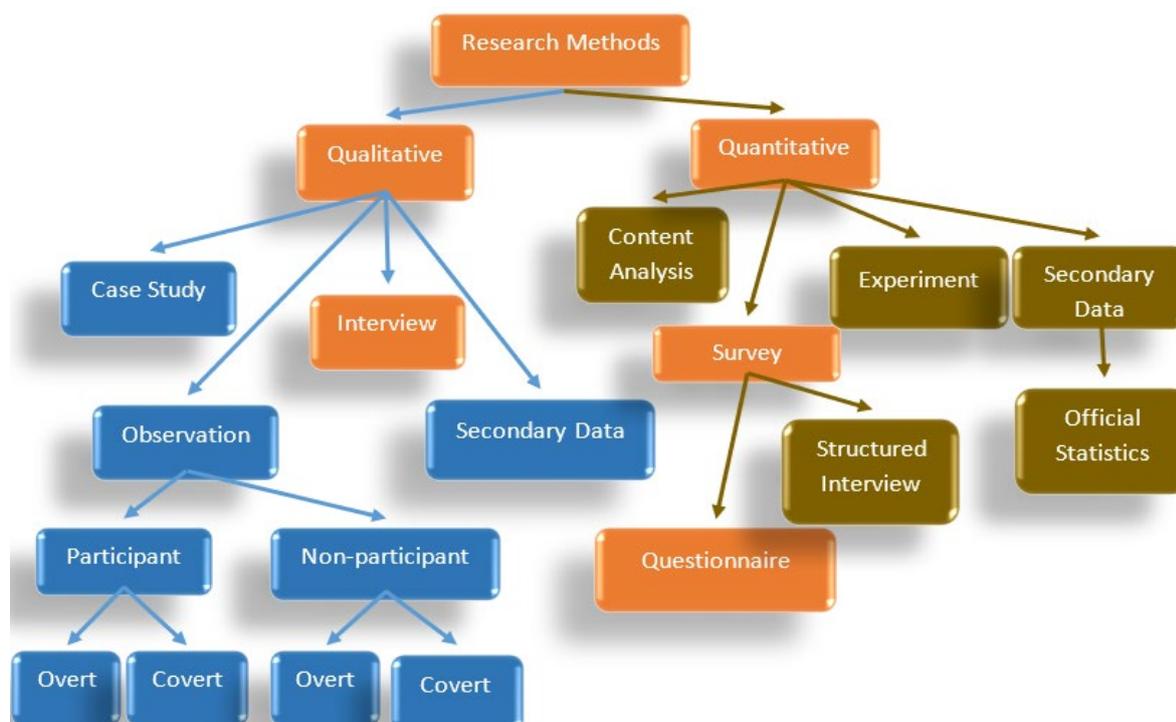
The essence of measuring accuracy and the consistency of data collection instrument such questionnaire can be referred to as validity and reliability. This is important because the data collected is used to deduce an inference based on certain evidence and reasoning. Therefore, inferences made depends on the type of measurement, such as survey in this study and using questionnaire as measurement tool through which data was captured. Questionnaire is a prearranged group of questions used to collect, record data about a specific topic of interest. However, this section seeks to clarify that, questionnaire used in this research truly measures the proposed research concept and this measurement tool quantify the variables with consistent responses. The study meets the two validity test requirements namely internal and external validities (Scribbr, 2019).

Internal validity is the accuracy of the measures obtained from the studies by quantifying what was meant to be measured. While external validity is the accuracy of the measures obtained from a population sample and how the sample describes the entire population it represents.

Reliability on the other side, means the extent to which the result obtained through a procedure or measurement can be duplicated or replicated. Hence, reliability strongly contributes to the validity of a questionnaire. This research is aware of the importance of reliability and validity. The study also meets the requirements of the three aspects of reliability such as stability, equivalence, and homogeneity.

This is concerned with the approach used to evaluate the accuracy of data collected and analysed. There are severe threats to research validity and reliability. First is the “Participant error”, which are factors that adversely affects participant’s responses for instance interview time may be inconvenient for both the researcher and the participant hereby resulting in a quick and intangible response. Also, secondly “Participant bias”, which can be seen as any factor that instigates a false response an example is interviewing a participant in an open office space or in the presence of the employer can possibly result in a bias response.

Third is the “Researcher error”, are factors which may possibly alter the data interpretation for instance fatigue might occur from conducting too many interviews within a short space of time.



And lastly, “Research bias”, factors are quite common; these are the induced bias in the researcher’s data collected. For instance, as humans we may be subjective and selective in response recording such that reflects been biased. In this research premium measures were put in place to ensure objectivity and fairness at all time. The diagram 4.1 below illustrates this research method used in colour codes: Orange is the method used in this research, while blue and brown are alternative methods.

#### **Fig 4.2 Research Method (Creswell & Poth, 2016)**

##### **4.4.5 Validation of questionnaire**

This study used stratified sampling approach to ensure that at least five (5) save regions of the six (6) geographical zones in Nigeria is covered in the research. Statistical analysis such as Cronbach’s Alpha and regression analysis for data validity and reliability were used in this study. Descriptive statistics such as means, standard deviations, and frequencies for various variables was calculated. Pilot study was carried out to determine the fitness of the questionnaire. Information was collected from several manufacturing organization in Nigeria. In the validation process, empirical findings were made to evaluate the differences in perception of ERP implementation in Nigeria’s manufacturing organisation.

The culture and practices related issues surrounding information technology and existing ERP systems were evaluated. Manufacturing companies were selected based on broad a representation of product, size and geographic location. The participants were asked carefully selected constructive questions. The analysis of these questions aided the identification of the main ERP adoption determinants and critical success factors which help in developing the Block-chain ERP model to enhance manufacturing productivity and business revenue.

#### 4.5 Variable measurement (Dependent and Independent variables)

Research defined variables as the key concepts of interest in a study (Stewart, 2010). Study variables are characterised in various ways and they have effects on data analysis. The approach of characterising a variable depends on its role in data analysis. According to Stewart, (2010) there are two types of main variables (dependent and independent variables). Independent can be referred to as a variable that is not affected or changed by other variables in other words stands alone. This variable is what researcher tries to measure (Stewart, 2010). For instance, some demographic characteristics of a participant such as “Age” may be an independent variable because it is not influenced by factors such as participant’s diet.

On the other hand, dependent variable depends on other factors such as the independent variable (Stewart, 2010). For Instance, income generated in an organisation could be considered as dependent variables because they could change depending on numerous factors such as sales, productivity and so on. Researcher’s studies are to examine the relationship between the variables. This a done by attempting to find out the effect of independent variables on dependent variable. These established definitions point us towards the variables in this study which are basically characterised as the followings; The dependent variables “Organisational performance” while the independent variables are the ERP critical success factors (CSFs) such as Top management support, ERP users efficiency” (staff’s skills and training), ERP Data quality, ERP ease of use, ERP fit for organisation and ERP Project Management.

**Tab 4.7 Description of ERP Critical success factors (Independent Variables)**

	Top management support
1	Management motivation and rewards systems towards a successful introduction of ERP system.

2	Management to set their goals, monitor their organisational performance.
	Management actively worked to address staffs concerns about ERP implementation by providing adequate allocation and distribution of resources needed.
	The management prepare staffs and stakeholders to respond positively to ERP implementation.
	Creating or upgrading the IT department to manage ERP system and process effectiveness.
	Aligning corporate strategy alongside continuous improvement.
	<b>ERP users efficiency (staff's skills and training)</b>
	Staffs education, training, capacity development, change and conflicts management to ensure successful ERP implementation.
	Efficient ERP in-house teams, credible, innovative and empowered to handle various aspect of the organizational needs.
	Staffs/ERP users active involvement throughout the ERP implementation stages.
	Awareness of the changes in job descriptions and allocated responsibilities as a result of jobs becoming Process-based rather than task-based.
	Experienced vendor, consultants and/or experts to support ERP implementation project
	<b>ERP Data quality</b>
	Collecting quality feedback informations periodically to encourage participation and measure employee satisfaction with ERP system.
	Quality data integration into the ERP system
	<b>ERP ease of use</b>
	ERP easy to learn and ease of use
	User-friendly interface with simplified access.
	<b>ERP fit for organisation</b>
	ERP seamless integration without any significant complication.
	Effective integration of organizational information systems such as data integration and communication networking
	<b>ERP Project Management</b>

	knowledge transfer and effective communication during the ERP project to ensure understanding of the Organizational changes
	Effective anticipation and planning for risks associated with ERP implementation project
	Effective use of project management techniques in smoothing the flow of ERP implementation and business process redesign
	Adequate information technology infrastructure to support ERP projects

**Tab 4.8 Description of Organisational Performance measures (Dependent Variables)**

	<b>Staffs/ERP Users Satisfaction</b>
	The management is fulfilled with the selected ERP System
	Staffs and customers are satisfied with the improvements in the quality of products after ERP implementation
	Staffs/end-users satisfaction with the ERP system as a result increasing employee participation and confidence.
	<b>Productivity and Profitability</b>
	Improved net profit position compared to competition
	Improved the rate of production, return on sales and investment.
	Improved return on assets (ROA) position compared to competition.
	<b>Growth</b>
	Improved deposits growth position compared to competition
	Improved Market share gains compared to competition
	<b>Customer Services</b>
	Exceeding customers expectation and satisfaction with improved product and services.
	Feedbacks on customers satisfaction with the newly adopted Customers relationship management module.

The propose model of the variables is represented in the diagram below;



**Fig 4.3 Dependent and Independent Variables**

#### 4.5.1 Quantitative empirical model

The statistical relationship between dependent and independent variable can be explained using a quantitative empirical model. This statistical model, relies on observation rather than theory. The observations carried out in some circumstance can then be used to reliably predict future outcomes. Linking the critical success factors (CSFs) to organisational performance as observed in the literatures. In the earlier chapters of this thesis, there are descriptions of set of variables created to be used in an empirical model. Chapter three(3) used a TOE framework to detail critical success factor. The critical success factors are the predictors of organisation performance as seen in the hyptohesis predictions of section (2.9).

Since we have multiple predictor variables, the multiple regression model will be used.

The equation of the multiple regression model for multiple variables is shown as follows:

$$y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_p X_p + \varepsilon$$

*Regression equation* whereby;

y = Dependent variable (Organisational performance)

$\beta_0$  = the intersect of the y axis

$\beta_1X_1 + \beta_2X_2 + \dots \beta_pX_p$  = independent variables with the coefficients (CSFs)

$\varepsilon$  = error term

Where by;

y = Organisational performance

$X_1$  = Top management support

$X_2$  = ERP users efficiency (staff's skills and training)

$X_3$  = ERP Data quality

$X_4$  = ERP ease of use

$X_5$  = ERP fit for organisation

$X_5$  = ERP Project Management

## 4.6 Sampling (Quantitative and Qualitative)

### 4.6.1 Quantitative Sampling

Quantitative part of this research initially utilized the convenience sampling technique to test the research questions as a pilot study. Before using a stratified sampling technique which is a type of probability sampling method (Blackstone, 2012) to carry out the main distribution of online questionnaire survey. The assistance of Manufacturer Organisations of Nigeria (MAN) made it possible to identify two thousand four hundred and ninety-three (2493) manufacturing organisations in various geographical location of Nigeria. Informations provided include Name of the organisations, what they produce, their site address, e-mail address, and telephone number.

The researcher identified a total population size of two thousand four hundred and ninety-three (2493) manufacturing organisations through the product registration details from Manufacturers association of Nigeria (MAN). This study used stratified sampling technique

for data collection to ensure a wide variety of participants (Creswell, et al., 2017). Manufacturing organisations workers/participants was gathered based on their “location” across the country (Online questionnaire was sent to all zones) and their “production category”. The participants are in different level of hierarchy ranging from the directors to ordinary team members and various departments were recruited to participate in the quantitative data collection stage, no restrictions.

The sample size calculator was used to determine the adequate number of questionnaires required for this study. The confidence level and confidence intervals are set at 95% and 5, respectively. A total of five hundred (500) online questionnaire survey was sent out with about 350 useful feedback collected evenly for each region/stratum. This stands at eighty-seven-point five percent (87.5%) response rate. The production categories range for Automobile, Electronics, Agriculture, Steel, Metal, cable, Construction materials, Stationeries, domestics, Food, Drinks, Tobacco, Industrial products, Wood or timber products and Other products.

#### **4.6.2 Qualitative Sampling**

Qualitative part of this study do not essentially require collecting data from everyone under study in qualitative stance. Because it do not necessarily ensure valid finding but data saturation (that is the point when newly collected data no longer provide new information that differs to those earlier gathered) in the research. In qualitative research a fewer sample (that is a subset of the entire population) is required compared to the quantitative research. There are few sample selection criteria which relies mainly on the research objectives and the characteristics of the entire study population (this include population size and diversity). This research adopted the “purposive sampling method” and its briefly described.

Purposive Sampling groups participants due to specific pre-selected criteria appropriate enough to answer the research question (for instance, Construction Project managers in London city).

Depending on the available time resources and the study objectives, sample size may not be fixed prior to data collection. The sample size mostly relies based on information saturation. This study adopted this method because the number of participants is not a fixed/strict prerequisite, which allows enough data collection until saturation is reached.

#### **4.7 Mixed method research**

Mixed method is particularly concerned with two fundamental issues. Firstly, the theoretical concern linked to any specific discipline in management, secondly is the extent to which the research approach is determined by the research question (Creswell, et al., 2017). Mixed method is a multi-disciplinary research approach with many of its facets beneficial to varieties of research discipline. A research should be able to make a concrete justification for selecting a certain method or methods for the purpose of validity and reliability of the research findings. Additionally, mixed method supports the inductive and the deductive research logic. The strength in having both inductive and deductive cycle in a single study is the opportunity for a researcher to equally explore theory generation and hypothesis testing without compromise for one or the other (Jogulu & Pansiri, 2011).

This allows the researcher to provide detailed inference in the study. As regards to Information Technology (IT) adoption, there are various methodologies that researchers can select from. However, it is important to adopt sophisticated research design, that allows multiple data collection technique and analysis that will produce valuable views and findings. The fundamental nature of the phenomenon surrounding IT adoption are extensive collection of theoretical beliefs (Jebreen, 2012). Also, analysing data using mixed methods will integrate both statistics and thematic approaches. Hence, this will allow triangulation to take place due to combining and comparing multiple data sources, analysis, and processes. Mixed method research is gaining huge acceptance as the third research approach which has become prominent in various disciplines (De Silva, 2011).

According to Teddlie & Tashakkori, (2011) findings about mixed methods of research which indicated that, such method allows the researcher to simultaneously provide answer to both quantitative and qualitative questions. This method of study combines elements of quantitative and qualitative views from data collected and its analysis in a single study either concurrently or sequentially (Creswell & Creswell, 2017). Mixed methods research considers the strength and minimise the weaknesses of both in single study, but not to compromise either of these approaches (Paradis, et al., 2016). Adopting mixed method enables researchers to reduce the dependency on statistical data in explaining a social observations and experience that are subjective to nature (Jogulu & Pansiri, 2011).

(Creswell, et al., 2017) Also supported the view that the use of mixed method in a study delivers strengths that balance the potency of both quantitative and qualitative approach. Also, the mixed method delivers comprehensive evidence for a research problem compared to using quantitative and qualitative individually. (Creswell, et al., 2017) Also indicated that mixed method research approach answer questions that cannot be answered in detail by either the quantitative or qualitative research approach alone. It encourages the use of multiple paradigms. The main strength of using mixed methods research methodology is the triangulation.

#### **4.7.1 Research Design**

The research design allows many research methods which involves the logical sequence of steps used to in data collection. When conducting a research, there is a need to focus on how it will be designed and conducted as well as the later part of writing-up the research finding. Research design is very dependent on the research strategy because it indicates the choice regarding strategy implementation. The design involves clear focus on what type of data (Evidence) would be most suitable to address the research questions. For instance, in case-

study research, the design will relate directly with the method of data collection e.g. If Interview is selected, there is need to know the type of interview, whom to interview, how many participants, interview duration, where will interview be conducted and How it will be recorded.

In the same vein, if observation is selected instead, the considerations are what to observe, for how long, which department or environment to observe and lastly how to record the observations. Research design can also be referred to as the strategies of inquiry (Denzin & Lincoln, 2011) because a research does not only select a quantitative, qualitative or mixed method to conduct a research but also decides the type of study inquiry within these three choices. Research design is referred to as inquiry within quantitative, qualitative, or mixed approaches to provide precise direction for procedure in the research. A simplified overview is shown in the table below.

**Tab 4.9 Overview of Alternative research approach**

	Quantitative	Qualitative	Mixed Methods
<b>Strategies of inquiry</b>	Experimental Design	Case study	Transformative, embedded, or multiphase
	Non-Experimental Design, which include surveys etc.	Ethnographies	Exploratory sequential
		Grounded theory	Explanatory sequential
		Phenomenology	Triangulation design
Narrative research			

#### 4.7.2 The Triangulation Design

The triangulation design is the type of design where the research executes both quantitative and qualitative methods within the same timeframe and attracting equal weight. As a result of this design timing, it has been referred to as the “concurrent triangulation design” (Creswell &

Plano, 2011). The process involves a parallel, simultaneous but separate quantitative and qualitative data collection and analysis. This enables the researcher to gain the best understand of the research problem. The researcher tries to combine both data sets results, usually by combining the separate results in the interpretation. Also, the combination can be achieved by transforming data to enable mixing the two data types during the analysis. Several studies have utilized this method such that that triangulation design is recognised as the most frequent approach to mixing methods is the (Creswell & Plano, 2011).

The essence and idea behind this design is to acquire different but complementary data on a particular subject matter, for best insight on the research question. Also, this design brings together the varying strengths and weaknesses of both methods. For instance, quantitative methods involve “a large sample size, data pattern or trends, generalization”, while qualitative methods involve “a small sample size, details data, in depth information”. Triangulation design fundamental purpose of converging different methods is often utilized when a researcher needs to compare and contrast the quantitative statistical results with the qualitative detailed findings. Also, it is done to expand quantitative results with the details of qualitative data. This concept has been extensively discussed to be very help in the literatures.

#### **4.7.3 Variants of the Triangulation Design**

There are four variants model of the triangulation design namely: convergence model, data transformation model, validating quantitative data model, and lastly the multilevel model. This research used the convergence model, the first and second models may differ in terms of how the research combines both data sets. The mixing can be either during result interpretation or data analysis, while the transformation model is used to enhance findings from a quantitative data, and the multilevel model is used to investigate various levels of analysis (Creswell, et al., 2017).

**Tab 4.10 The Types Mixed Methods Design (Creswell & Plano, 2011)**

Design Type	Variants	Timing	Weighting	Mixing	Notation
<b>Triangulation</b>	Convergence	Concurrent: quantitative and qualitative at same time	Usually equal	Merge the data during the interpretation or analysis	QUAN + QUAL
	Data transformation				
	Validating quantitative data				
	Multilevel				
<b>Embedded</b>	Embedded experimental	Concurrent or sequential	Unequal	Embed one type of data within a larger design using the other type of data	QUAN(qual) or QUAL(quant)
	Embedded correlational				
<b>Explanatory</b>	Follow-up explanations	Sequential: Quantitative followed by qualitative	Usually quantitative	Connect the data between the two phases	QUAN qual
	Participant selection				
<b>Exploratory</b>	Instrument development	Sequential: Qualitative followed by quantitative	Usually qualitative	Connect the data between the two phases	QUAL quan
	Taxonomy development				

Once again, it is important to note that this research utilized the convergence model which is represented in the fig. 4.3 below. The model represents the conventional approach of a mixing methods triangulation design (Creswell, et al., 2017). This model allows both quantitative and qualitative data to be collected and analysed separately. That is, it is done in the same stance and the varying results are compared and contrasted by converging during interpretation. This model compares, validates, confirms, and/or corroborates quantitative results with qualitative findings. The drive is to reach a valid and well-verified conclusion about a particular topic.



**Fig 4.3 Triangulation design: Convergence model (Jogulu & Pansiri, 2011)**

#### 4.8 Research Strategy

The research strategy introduces the main research components which include, the research area, perspectives, design, and the methods. Research strategy also indicate the proposed procedure to address the research questions and how the research methodology will be implemented. The diagram below fig 4.6 indicates four major types of research strategy namely, qualitative interviews, quantitative survey, case study, and action-oriented research. The first three strategies are widely used by researcher unlike the fourth (Action-oriented research).



**Fig 4.4 Major research strategies (OpenLearn, 2020)**

This research can be carried out towards implementing a change recommendation. This kind of research is a participatory process which act simultaneously on theory and practice. This research is often done by managements or insiders because it involves active participants to develop the project and implement the change. The type of research to be carried out strongly influences the research strategy. Hence, it is said to be dependent on what type of research to be done. One of the crucial aspects of research studies is selecting a suitable research design. This is referred to as one of the most significant phases when writing any thesis. According to Jebreen (2012) research strategy is the means of conducting research, using a specific research approach and using diverse research methods for data collection.

This research supports the examination of various research strategies, in order to choose a suitable one that would support and enhance data collection and analyses. Considering the investigated attributes of the research, a research strategy should be justified in the direction of these research attributes. According to Creswell & Plano, (2011) even though there are numerous strategies but the most used of them include the case studies base research, survey, field study, longitudinal studies, experiment, action research, grounded theory, exploratory, ethnography, explanatory and descriptive research studies. In latter studies researchers such as (Aberdeen, 2013) and (Yin, 2009) emphasis the reason to concentrate on the following criteria below to select and or distinguish amongst different research strategies;

- ❖ Research question(s) proposed by the research.
- ❖ Degree of author's influence on accurate behavioural reports, and
- ❖ Current proposed findings as compared to those of the preceding reports.

These three criteria can be further broken down into six key factors that influences the research strategy.

1) **Goals:** Research goals should be the first consideration, when selecting a research strategy. Hence, considering what the research needs to accomplish will greatly inform the methodology and strategy to adopt. Knowing the proposed research result and type of information to be gathered at the end of the project's will often point you towards available strategies which will be suitable for the research from the beginning.

2) **Statistics:** Statistical Significance is next once the research goals have been established. In a situation where a result is statistically significant, this means that it is unlikely that the result occurred incidentally or by chance. If the research requires an assertive, strong, clear-cut, extremely data-driven research results, then you might be mostly looking for a statistically significant result. Therefore, there will be need for quantitative data, and respectively large sample size. This factors that influences your research strategy. Statistical evidence is vital when generalising results from a sample set to a larger population, which is significant to consider in research.

3) **Quantitative or/and Qualitative Data:** It is vital to identify what data will be needed be it quantitative data, qualitative data, or mixed. After considering the statistical significance of data, the strategy used to capture data is very important, for instance in the case of capturing consumer insights and open-ended reactions, the qualitative approach such as the focus groups can be very suitable in this case. Other means to collect qualitative data include highlighting tools and heat maps, this allows participants/consumers to indicate areas of strong like or dislike. On the other hand, quantitative data provides more precise and statistically proven results. In cases where many questions needed to be communicated across to the participants, a survey/questionnaire with quantitative questions may be more suitable, as consumers can answer these at their convenience with desired answer options. Most importantly, there are new online survey tools that are more interactive enhancing quantitative questions by helping to prevent survey fatigue.

4) **The Sample Size**: When considering your research strategy, sample size regularly comes into consideration, it also helps in selecting a research method. How large is the sample size needed to be confident enough in making concrete and strategic decisions based on research results? An instance is a business scenario where the price acceptance limit for a new product is being investigated, the confidence in the results after surveying 20 people will be quite different compared to surveying over 2,000 participants. Therefore, the required sample informs the research strategy.

5) **Timing**: How quickly the results are needed can also be considered. Considering the urgency research result, the quick turns on completion of data collection might be important. Hence, in such situation the researcher is likely to consider an online survey, where it can be sent out to thousands and hundreds of participants via e-mail and other social media, which can then be completed in just a few days. On the other hand, where there is longer lead time, other methods can be used that are more time-consuming, such as one-on one interview. The so-called timing will also have an effect on the screening criteria used for participant selection, because depending on how strict the screening criteria are, the longer or shorter is the time it will take to find the required number of participants.

6) **Available Existing Information**: This factor is often overlooked. The availability of information, considering if the data needed does already exist through different sources. In a situation where there is adequate prior existence of required data you, the researcher may not be required to conduct primary research, in such case the researcher may be able to achieve the research study by conducting a secondary research. Although, a secondary research may not be as customizable as conducting primary research but nevertheless, it is a valuable research resource for lots of topic areas. These six factors tremendously assist in when selecting a research strategy which will help the research to successfully navigate the research process and, more importantly, achieve the research aims and objectives.

## **4.9 Conclusions**

The philosophical assumptions underpinning this research was detailed in this chapter. The chapter explains the research recruitment process, settings, and justified how a sequentially mixed methods was used to address the research questions. The adopted quantitative and qualitative approaches was discussed, and validation rationale was explained. The participants' eligibility criteria were outlined with the recruitment process for the study and the "sample size" consideration was addressed. The data collection methods for both quantitative and qualitative approach were described along with the theories that supports them. The data analysis was discussed, and data triangulation was addressed with reference to a mixed methods design. The next chapter present findings and analysis of the quantitative and qualitative phases of this research.

# **CHAPTER 5**

## **FINDINGS AND ANALYSIS**

### **5.1 Introduction**

Data analysis and findings is discussed in this chapter. This justifies the research context in the introduction chapters and literatures reviewed in the second chapter, proposed conceptual framework in the third chapter and the research methodology adopted in the later chapter. ERP system adoption and implementation in Nigeria requires continuous research for further knowledge. The reliability of data collected is assessed using the coefficient alpha or Cronbach's Alpha. Some of the factors considered during data collection includes; evaluating the factors that influence ERP adoption and the critical success factors (CSFs) for ERP system implementation with their impact on business performance.

Statistical variables for ERP critical success factors were used to measure business performance within the Nigeria manufacturing organisations (NMO). The analysis of the findings was done based on the results of the data collected. Hence, it forms the basis for the final model design and proposing further recommendations for appropriately adopting and implementing a blockchain integrated ERP system (B-ERP) in the Nigeria manufacturing industry. The author adopted both the qualitative and the quantitative approach to collect and analyse data for this study, as this was found to provide enough information that assisted and supported the author in justifying and validating the research presented in this thesis.

A detailed semi-structured interview with participants from the Nigeria manufacturing sector was analysed. The quantitative data that was collected by using questionnaire survey was also analysed and presented in this chapter. The two methods (qualitative and quantitative) were used in a way that thoroughly examine the state of ERP adoption and implementation within the Nigeria manufacturing organisations. In addition, research propositions defined in Chapter Three namely, (a) factors influencing ERP adoption (b) Evaluating the critical success factors for ERP implementation (c) Designing ERP implementation framework based on findings and recommendations.

This analysis provided an understanding of how ERP is adopted and implemented in the practice and related to what was stated in the literature. These was included in the conceptual findings in the second and third chapters. This further evaluates the feasibility of adopting and implementing the proposed blockchain-ERP (B-ERP) framework in the Nigeria manufacturing sector. Karl Pearson coefficient of correlation will be used to evaluate the correlation between relative factors such as performance evaluation in the validation chapter where end user's view on blockchain-ERP (B-ERP) was analysed. In this chapter, the impact of ERP on the functional units and the success factors (CSFs) are statistical analysed. From the analysis, the departments

that appears really challenging and needs redesign within Nigeria's manufacturing organisations was identified as the inventory management and finance.

### **5.1.1 Chapter Objectives**

The objectives of this chapter are to present the data analysis and interpretations of findings from the survey questionnaire and interviews questions. The main objective of this chapter is to implement the research plan by collecting data, analysing the findings generated. According to the results obtained from data interpretation, there will be a validation finding to find out if the proposed framework supports research proposition. These research propositions encapsulate the research objectives and main research aim of the study. The research propositions also cover different constructs embedded in the ERP adoption and implementation success that led to theoretical underpinning organisational performance. In addition, analysis within this chapter is meant to generate a clear note between theoretical proposition and practical experience.

### **5.1.2 Chapter Structure**

This chapter has few sections, including an introduction to the chapter, and an analysis of survey findings to understand the extent of ERP systems implementation within the Nigeria manufacturing organisations. Followed by analysis of the findings from the two-research approach (qualitative and quantitative) to gain a richer understanding of the nature of ERP implementation, how the systems have been used and the degree of success that has been achieved. Providing in depth analyses of three-dimension (a) factors influencing ERP adoption (b) Evaluating the critical success factors for ERP implementation (c) Designing ERP implementation framework based on findings and recommendations. This section also triangulates the overall findings from both research approach (qualitative and quantitative) in the concluding part.

## **PART ONE: Quantitative Phase**

### **5.2 The quantitative findings context**

This section presents the findings from the quantitative phase of this study. The chapter also justifies the research context in the previous chapters and commensurate with the research methodology adopted in this writing. The section breakdown structure is as follows. Section 5.2 describes the study context, which shows where the findings were obtained to support the research. Section 5.3 represents the finding from the data analysed in the quantitative phase. This phase involves months of rigorous study that describes ERP knowledge, extent of ERP adoption and implementation within the NMOs, ERP system adoption impact on productivity and profitability, critical success factors (CSFs), factors that influence ERP system adoption and desirable IS features within the NMOs. The chapter describes the study participants demographics, and other characteristics. It also reports the statistical representations of factors influencing ERP adoption and implementation and prioritising the importance of each factor.

#### **5.2.1 Demographical Analysis context**

This section describes the demographical context in which data was collected and information obtained. The research proposition covers various aspects of ERP adoption and implementation process. The propositions are tailored towards the theoretical underpinning that supports the need to investigate ERP re-design within the Nigeria manufacturing sector. The participants were informed about the data collection for the purpose of this research. Also, the online questionnaire distributed was detailed with regards to making sure the participants knows what is expected of them. A simple “google form” questionnaire model was utilized and a sample size of (350) from a population of (2493) manufacturing organisations Nigeria (NMO) was used.

The sample size calculator was used to determine the adequate number of questionnaires required for this study. The confidence level and confidence intervals are set at 95% and 5, respectively. A total of 400 online questionnaire survey was sent out with about 350 useful feedback, that is eighty-seven-point five percent (87.5%) response rate. Demography is the statistical study of the information provided by the participants about themselves. It can also be referred to as socio-demographic data.

Tab 5.1 Quantitative participants demographical representation

<b>Tab 5.1a Please indicate your regional part of Nigeria</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	North West	29	8.3	8.3	8.3
	North Central	26	7.4	7.4	15.7
	South East	98	28.0	28.0	43.7
	South south	71	20.3	20.3	64.0
	South West	126	36.0	36.0	100.0
	Total	350	100.0	100.0	

<b>Tab 5.1b What is your company's product category?</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agricultural	99	28.3	28.3	28.3
	Automobiles	6	1.7	1.7	30.0
	Construction	45	12.9	12.9	42.9
	Domestics	86	24.6	24.6	67.4
	Electrical and Electronics	9	2.6	2.6	70.0
	Food, Drinks and Tobacco	77	22.0	22.0	92.0
	Print and Ink	17	4.9	4.9	96.9
	Steel and Metal	11	3.1	3.1	100.0
	Total	350	100.0	100.0	

<b>Tab 5.1c What is your level of authority in the organisation?</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent

Valid	Top Management level	285	81.4	81.4	81.4
	Middle Management level	25	7.1	7.1	88.6
	Line Management level	40	11.4	11.4	100.0
	Total	350	100.0	100.0	

**Tab 5.1d How long have you been using ERP?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5-10 years	49	14.0	20.1	20.1
	1-4 years	195	55.7	79.9	100.0
	Total	244	69.7	100.0	
Missing	999	106	30.3		
Total		350	100.0		

**Tab 5.1e What category of ERP system is adopted in your organisation?**

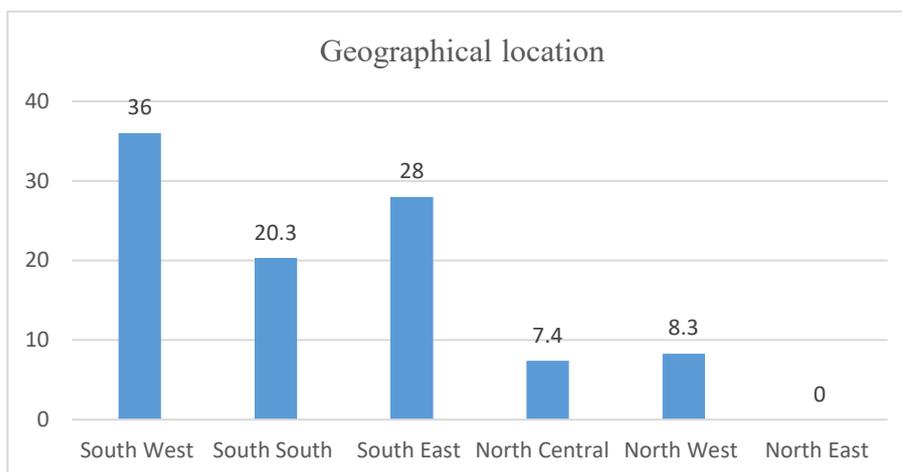
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Client, server, and database (On premise)	2	0.57	0.8	0.8
	Cloud based ERP system (Web based/EDI)	242	69.1	99.2	100.0
	Total	244	69.7	100.0	
Missing	999	106	30.3		
Total		350	100.0		

### 5.2.2 Summary of the Participants characteristics

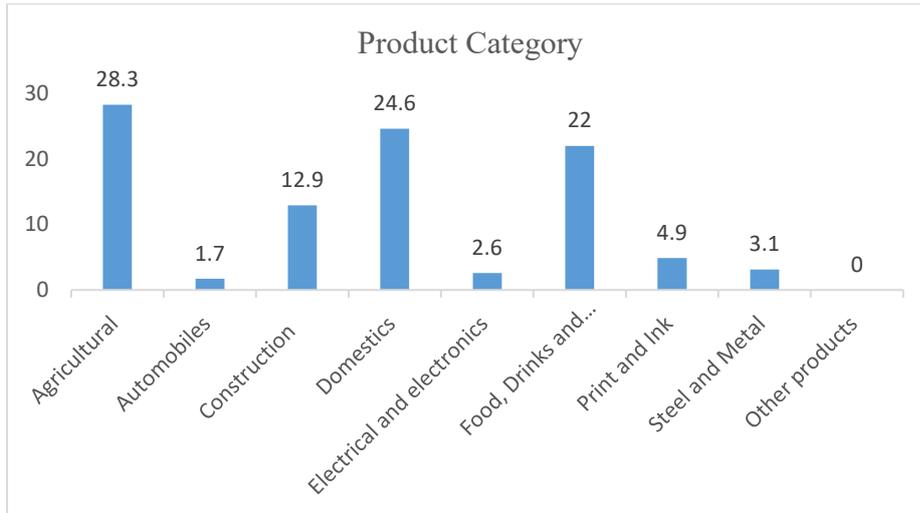
The overall summary of the participants characteristics is deduced according to the sample of “Three hundred and fifty” (350) properly answered questionnaire. The sample was used to summarize and represent the entire NMO population. These findings do not in any way attempt to invalidate any other research or agency’s findings but to add to the body of knowledge. The summary indicates that the “South west region” of the country appear to accommodate the highest percentage

(36%) of manufacturing organisations with a total of “One hundred and twenty-six” (126) manufacturing organisations, next is the “South East” with (28%) of about “eighty-two” (98) manufacturing organisations and so on.

The product category section reflects that agricultural product manufacturing is high in Nigeria. The number of organisations in this product category is “Ninety-nine” that is (28.3%) of the overall data collected. According to the survey the next in line is a closely related category “Food, Drinks and Tobacco” with (22%) and “Seventy-seven” in. number. The next characteristics describes the status of the participants in their organisations, respectively. Statistics shows that the majority of the participants are the “Top management” of about “Two hundred and eighty-five” (285) in number that is (81.4%). Lastly is the “Years of experience”, which shows that non-ERP users are less than half of the data collected. However, statistics shows that none of the organisation’s participant has over 10years of experience. About 20.1% possesses within 5-10years and 79.9% has within 1 – 4years of ERP experience. The graphical representation of each is shown in the charts below.



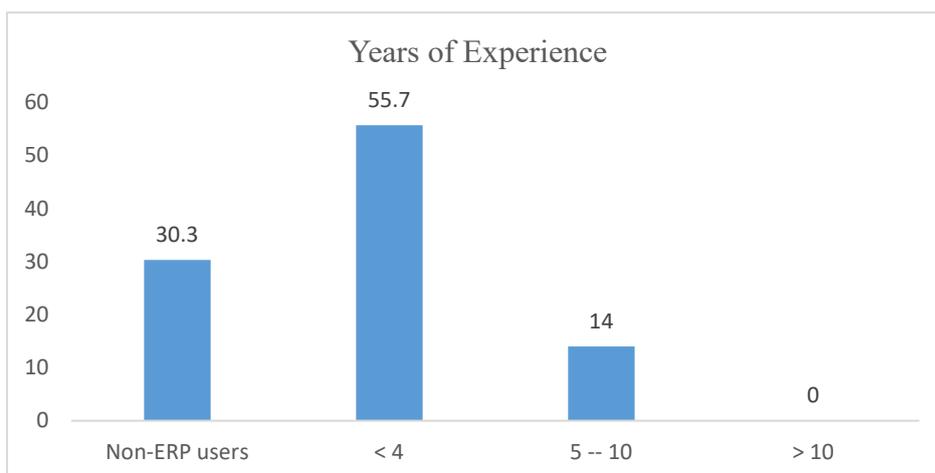
***Fig 5.1 Geographical Location***



**Fig 5.2 Product Category**



**Fig 5.3 Geographical Location**



**Fig 5.4 Years of Experience**

### 5.2.3 SPSS and Reliability Test

Statistical Package for the Social Sciences (SPSS) software was used to analyse the data collected from the survey. By calculating Cronbach's Alpha, the data reliability was determined. In this study, reliability was established by using a pilot test by collecting data from within 25 to 40 subjects which was not included in the sample. The data collected in the pilot test was analysed using SPSS which provided two key pieces of information in the output viewer, which are the "correlation matrix" and "view alpha if item deleted" columns. Cronbach's Alpha is used to determine that the scale is reliable. A reliability coefficient greater than  $>0.70$  was achieved in this study, which indicates an acceptable degree of reliability in SPSS. Hence, it is a measure of internal consistency (reliability). To determine if the questionnaire and the questions are reliably measured with the same latent variable. However, Cronbach value could be affected by the conditions below.

- a) Distribution of score increases Cronbach values while skewness data reduces.
- b) Cronbach alpha does not indicate the consistency or stability of the test over time.
- c) The numbers of items; scale of  $<10$  variables could cause the Cronbach values to be low.
- d) Eliminate items with 0,1 and negative scores values.
- e) Negative worded questionnaire needs to be inverted before scoring.

**Tab 5.2 Cronbach's Alpha**

<i>Tab 5.2a Case Processing Summary</i>			
		N	%
Cases	Valid	244	56.9
	Excluded <sup>a</sup>	185	43.1
	Total	429	100.0

a. Listwise deletion based on all variables in the procedure.

<b>Tab 5.2b Reliability Statistics</b>			
Variable Construct	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
CSFs	0.783	0.785	11
Organisational Performance	0.758	0.760	6
Influencing factors	0.712	0.710	16
ERP User's Satisfaction	0.760	0.762	6

The information from the table above shows that the Cronbach's Alpha is 0.767 which indicates a relatively adequate level of internal consistency in the chosen scale and sample. According to Pallant (2013) anything from  $\geq 0.70$  is okay.

### 5.3 Descriptive Statistical analysis Interpretation

Descriptive statistics commonly uses the mean as a standard measure of the distribution centre of the data. This is useful for describing the basic features of data such as summary statistics. The descriptive statistical analysis interpretation is used in this study in order to manage the data and present it in summarized tables. For example, comparing the data collected from various participants and correlating variables. Mean is defined as the summation of different variable value, divided by the number of items. Also, standard deviation is very important. It is defined as the square root of the means of the squared deviation from the mean. The degree of uniformity of observation/information is represented by the value of standard deviation. That is small value of standard deviation indicates high uniformity and vice-versa.

Skewness provides insight on the direction and the deviation from symmetry. It indicates symmetry of the distribution. Kurtosis on the other hand indicates the condition of attaining specific peak of the distribution. It is a measure of combined sizes of the two tail, measuring the amount of probability in the tails. In a perfect distribution the value of skewness and kurtosis is zero, although this is uncommon and can be said to be imaginary (Pallant, 2013).

This study used the descriptive statistics to answer some of the research questions such as “ERP system knowledge within the Nigeria Manufacturing Organisations” represented in the table 5.2 below.

**Tab 5.3 Please indicate your ERP knowledge level**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	ERP Beginner	187	53.4	76.6	76.6
	Intermediate ERP user	52	14.9	21.3	98.0
	Expert ERP user	5	1.4	2.0	100.0
	Total	244	69.7	100.0	
Missing	999	106	30.3		
Total		350	100.0		

The table indicates that the knowledge of Enterprise Resource Planning (ERP) within the Nigeria Manufacturing Organisations is still very low due to recent adoption as describes by the years of experience. Also, the “factors influencing ERP adoption”. to show the rating of the factors considered by ERP using organisations pre-adoption. While non-users rate the factors according their level of importance to their organisations, respectively.

**Tab 5.4- Descriptive Statistics: Factors influencing ERP adoption**

Variable description	N Statistic	Mean Statistic	Std. Deviation Statistic	Skewness		Kurtosis	
				Statistic	Std. Error	Statistic	Std. Error
'Cost and Funding'	350	1.60	1.209	1.977	.130	2.521	.260
'Enhance production and profitability'	350	1.85	1.303	1.310	.130	.511	.260
'Trust and Reliability'	350	1.89	1.384	1.336	.130	.382	.260
'Management Commitment'	350	2.05	1.450	1.090	.130	-.271	.260
'Effectiveness and efficiency'	350	2.16	1.376	.910	.130	-.344	.260
'Required skills and training'	350	2.99	1.465	.284	.130	-1.383	.260
'User friendly/Less complex'	350	3.06	1.137	.311	.130	-.219	.260
'Information Awareness'	350	3.08	1.430	.142	.130	-1.223	.260

'Management decision accuracy'	350	3.09	1.158	.305	.130	-.379	.260
'Real time information'	350	3.16	1.216	.233	.130	-.687	.260
'IT Infrastructure'	350	3.18	1.337	.110	.130	-1.048	.260
'Unified database access'	350	3.20	1.127	.391	.130	-.519	.260
'Business size'	350	3.21	1.350	.066	.130	-1.082	.260
'Government policies and support'	350	3.22	1.356	.100	.130	-1.107	.260
'Maintaining your competitive advantage'	350	3.39	1.142	.153	.130	-.694	.260
'User-user Interface'	350	3.40	1.158	.316	.130	-1.138	.260
'Customer requirement'	350	3.46	1.101	.380	.130	-1.128	.260
'Technological advancement'	350	3.50	1.165	.126	.130	-1.045	.260
'Process improvements'	350	3.54	1.126	.268	.130	-1.338	.260
Valid N (listwise)	350						

According to the ascending order of ranking the factors influencing ERP adoption in SPSS. The Likert scale used for “most important is (1) down to “least important” (5). Therefore, the lowest mean is representing the most important factor within the Nigeria manufacturing organisations according to the research findings. As expected, and according to other research finds “Cost of adoption” appears to be the major influence on ERP adoption. Next is the evaluation of how ERP system will enhance “production and profitability”, which can be attributed to be the main focus of every organisation. The third factor which is the “Trust and Reliability” is the major concern of this research due to corruption practices within the NMO. The level of corruption makes this factor very delicate to deal with.

The next Table 5.3 describes the ranking of the factors believed to be the “Critical Success Factors” according to the research findings. This shows the importance rating of the factors considered by ERP using organisations post-implementation.

**Tab 5.5- Descriptive Statistics: Critical Success Factors (CSFs)**

	N	Mean	Std. Deviation	Skewness		Kurtosis	
				Statistic	Std. Error	Statistic	Std. Error
'Effective Knowledge Transfer and communication'	244	2.28	1.461	.811	.156	-.671	.310
'Continuously training and development'	244	2.60	1.489	.433	.156	-1.092	.310
Project Management	244	2.61	1.471	.411	.156	-.482	.310
Top Management support and Effective leadership.	244	2.64	1.394	.400	.156	-.883	.310
'Quality data management"	244	3.03	1.191	.298	.156	-.437	.310
ERP users efficiency (staff's skills and training).	244	3.03	1.191	.298	.156	-.437	.310
'Change Management'	244	3.05	1.196	.312	.156	-.500	.310
'Fit between ERP and business'	244	3.09	1.280	.198	.156	-.817	.310
'Vendor Partnership and continuous support'	244	3.13	1.272	.219	.156	-.845	.310
Ease of use and ERP User-Satisfaction	244	3.14	1.330	.126	.156	-.978	.310
'Cultural change readiness'	244	3.28	1.149	.487	.156	-1.031	.310
'Seamless Integration'	244	3.41	1.185	.259	.156	-1.195	.310
Valid N (listwise)	244						

The critical success factors (CSFs) table indicates the importance of knowledge transfer and communication in the whole organisation. There should be a continuous knowledge transfer from vendor to the management and the entire ERP users. The functional units and departments should get used to the unified system of communication. The findings described employee training and effective project management as very important to the success of enterprise resource planning (ERP) system.

**Tab 5.6- Descriptive Statistics: Challenging unit**

N	Minimum	Maximum	Mean	Std. Deviation
---	---------	---------	------	----------------

'Account and finance'	350	0	1	1.28	.243
'Human resources and pay roll'	350	0	1	2.60	.482
'Sales and Marketing'	350	0	1	2.61	.483
'Inventory/Stock management'	350	0	1	1.64	.417
'Customer resource management'	350	0	1	3.03	.482
'Supply-chain management'	350	0	1	1.03	.452
Valid N (listwise)	350				

The descriptive statistics shows that some of the most challenging functional units or departments within the Nigeria Manufacturing Organisations include: Account and finance, Inventory/stock management and lastly the Supply-chain management.

#### 5.4 Statistical relationships between variables

The study examines the relationships between ERP implementation impact which is referred to as the “dependent variable” and various statistical factors that can influence a successful implementation of enterprise resource planning system within the Nigeria manufacturing organisations.

##### 5.4.1 Correlation between variables

The “Pearson Correlation” function of SPSS was used to evaluate the statistical significance of “Organisational Performance” and “ERP user’s satisfaction” on the manufacturing organisation’s “functional units”. The evaluation is according to the responses of the study participants. The correlation can start from “zero” which means no correlation at all to “one” which indicates a perfect linear association. The positive and negative signs only indicate the direction of correlation i.e. in a positive correlation if one value increases the other also increase and vice versa for negative correlation. The information provided insight into the variables whether they vary or correlate with each other. A detail representation of the correlation analysis is shown in the table below.

**Tab 5.7 Correlations Table**

		Organisational Performance	Acc & finance	'HRM & payroll'	S & M	'Inventory/Stock management'	CRM	SM	ERP User Satisfaction
Organisational Performance	Pearson Correlation	1	.026	.550	.518	.088	.710	.005	.609
	Sig. (2-tailed)		.690	.038	.031	.171	.006	.943	.001
ERP User Satisfaction	Pearson Correlation	.609	.532	.428	.412	.428	.642	.770	1
	Sig. (2-tailed)	.001	.042	.048	.050	.048	.008	.022	

\*. Correlation is significant at the 0.05 level (2-tailed).

\*\*. Correlation is significant at the 0.01 level (2-tailed).

The table examines the correlation of (Organisational Performance and ERP user's satisfaction) with the manufacturing organisation's functional units. According to the ( $P < 0.05$ ) value, Organisational Performance is statistically significant with a positive correlation in functional units such as Sales & marketing, Human resource, and Customer resources. And for ( $P > 0.05$ ) units such as Accounting & finance, Inventory/stock management and supply-chain, there was no statistical significance in Organisational Performance on these functional units. Also, ERP user's satisfaction is statistically significant to Organisational Performance. However, the statistical result shows that ERP user's satisfaction has a relatively statistically significant impact on every functional units of the organisation with a  $P < 0.05$  value .

#### 5.4.2 Multiple regression analysis

The regression statistical analysis presents the relationship between a metric "dependent variable" and one or more independent variable. Standard regression coefficient can also be referred to as beta coefficient, which is the slope found in a regression of Y on X with a standardised data. Strength of relationship in multiple regression is measured by the R-square ( $R^2$ ) which can also be referred as the coefficient of multiple determination. R-square ( $R^2$ ) is the statistics that evaluates the percentage of variation in the dependent variable. In this

analysis, the value  $R^2$  is 0.364 which implies that 36% of the dependent variable “Organisational Performance” can be accounted for with the predictors “critical success factors” which are the independent variables.

**Tab 5.8 Regression Summary**

<i>Model Summary</i>				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.567 <sup>a</sup>	.364	.281	.81086

a. Predictors: (Constant), 'Team work efficiency', 'Fit between ERP and business', Training and development', 'User-Satisfaction, Effective Knowledge Transfer, 'Seamless Integration', 'Cultural change readiness', Vendor support', Management support", Quality data management"

<i>ANOVA<sup>a</sup></i>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9.482	10	.948	2.674	.003 <sup>b</sup>
	Residual	327.940	233	1.407		
	Total	337.422	243			

a. Dependent Variable: Organisational Performance

b. Predictors: (Constant), 'Team work efficiency', 'Fit between ERP and business', Training and development', 'User-Satisfaction , Effective Knowledge Transfer, 'Seamless Integration', 'Cultural change readiness', Vendor support', Management support", Quality data management"

<i>Coefficients</i>						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.095	.392		10.457	.000
	Fit between ERP and business	.005	.062	.005	.080	.000
	Effective Knowledge Transfer and communication	1.129	.357	-.490	-2.275	.014
	Ease of use and ERP User-Satisfaction	.465	.161	.252	-1.758	.001
	Vendor Partnership and continuous support	.059	.087	.064	.685	.494
	Project Management	1.173	.357	-.490	-2.275	.014
	Quality data management	1.065	.361	.452	3.758	.009
	Change Management	1.076	.357	-.490	-2.275	.014
	Top Management support and Effective leadership	.629	.278	-.152	-1.643	.021
	Cultural change readiness	.325	.121	.332	-1.112	.039

Seamless Integration	.051	.078	.331	.147	.195
Continuously training and development	.549	.057	.062	.867	.001
ERP users efficiency (staff's skills and education).	.465	.161	.252	-1.758	.019

a. Dependent Variable: Organisational Performance

The coefficient table are the actual regression coefficient which contains the slope and the intercepts. The first line is the “constant” and it represents the intercept. In this analysis the intercept starts at “4.095” which is not very important. However, the slope is represented from the next line 'Fit between ERP and business' to the rest of the CSFs and the relationships between “Organisational Performance” and the “critical success factors (CSFs)” meaning for instance when “knowledge transfer goes up by “1” Organisational Performance goes up by “1.073”. This means ERP Organisational performance will increase if the CSFs increases. Also, the P value indicates that the CSFs are statistically significant except values “vendor support” and “fit between ERP and business strategies).

### 5.5 Hypothesis testing

Statistical analysis was used to examine the relationships between ERP implementation critical success factors and Organisational Performance on business production and profitability. Pearson correlation analysis and the regression p-value was used to examine the research responses. The information provided explains whether there is a correlation within the variables or not. The details are represented in the table below and statistical analysis is displayed in the appendix.

<i>Tab 5.9 Hypothesis Summary of relationship between CSFs and Organisational Performance.</i>						
	Variables	Pearson correlation	Sig/ P-value	Statistical Significance	Relationship strength	Hypothesis
H <sub>1</sub>	Fit between ERP and business	.488	.000	Yes	Moderate	Accept

H <sub>2</sub>	Ease of use and ERP User-Satisfaction	.609	.001	Yes	Moderate	Accept
H <sub>3</sub>	Top Management support and Effective leadership	.191	.021	Yes	Weak	Accept
H <sub>4</sub>	Quality data management	.440	.009	Yes	Moderate	Accept
H <sub>5</sub>	Project Management	.350	.014	Yes	Mild	Accept
H <sub>6</sub>	ERP users efficiency (staff's skills and education).	.110	.019	Yes	Weak	Accept

*Dependent variables: Organisational Performance.*

## PART TWO: Qualitative Phase

### 5.6 The qualitative findings context

This part presents the findings of the qualitative phase of this study. The findings are described by reporting key element in the themes that emerged from the semi-structured face-to-face interviews. The aim of this qualitative part is to gain deeper understanding of the research problem. As the quantitative and qualitative data collection was done separately but within the same phase of the research and roughly same time (Creswell & Plano, 2011). The quantitative data was then analysed separately, and the interviews analysis was carried out separately. Following the analysis, the research attempts to merge the results of both by bringing the separate findings together in the interpretation.

According to mixed methods triangulation design to collect different but complementary data on the same research topic. To understand the research problem and answer the research questions. This is achieved by bringing together the unique strengths and lapses of quantitative methods such as the large sample size, trends, generalization, and those of qualitative methods smaller sample size but with in-depth details (Creswell & Plano, 2011). There is a core

knowledge to be developed from this phase, which mainly is to identify how ERP system implementation model can be re-designed to improve productivity, profitability overall organisational performance. This is guided by the four (4) main questions below:

- i) What are the factors influencing ERP adoption?
- ii) What are the factors that hinders ERP success and what the implementation critical success factors?
- iii) How is Organisational Performance on organisational performance evaluated?
- iv) What are the desirable features that could enhance Organisational Performance on overall organisational performance?

The data collection for the qualitative phase was achieved with a semi-structured interview. The interview responses present in-depth knowledge of the research problem and supports the quantitative findings. The interview sections gave the management of MNO to express their profound concerns about productivity and profitability. During the interview section participants were able to explain their level of ERP understanding, factors that influence ERP system adoption and desirable IS features which can improve the ERP users experience for their organisations, respectively. The interview responses were analysed by identifying the themes and underlining the significant element in each theme.

### **5.6.1 Basic steps for indexing the qualitative transcripts**

Indexing in qualitative analysis can also be referred to as a “coding” which simply means words or a short phrase that represent the essence of key point of narrative information or verbal expression. The indexing steps are listed and described below:

- 1) **Reading the transcript**: The whole transcript was read through multiple times and the first impression notes was drafted.

- 2) **Indexing:** The next step was labelling the relevant words, sentences, and phases in the transcript. The label was used to index the opinions, concepts, process, and other relevant activities narrated by the participants. Relevance is determined by severally repeated words, surprising findings, interviewee emphasis on a statement, similarity in previous published facts. Themes are then created by bringing several codes together and prioritizing them according to level of importance in various categories.
- 3) **Themes categories:** This final categories in the analysis include, identifying the adoption Influencing factors, identifying critical success factors (CSFs), performance barriers, desirable features, and recommendations.

The analysis is aimed at making sense of a lot of unstructured and semi-structured data collected in form of interview transcripts. The connections among all the themes are later discussed.

### 5.6.2 Description of the participants

The number of participants selected initially was twenty-five (25) and the selection involves consented participation in the interview process. However, after interviewing (fifteen) 15 participants, there was no further need to continue due to data saturation. The participants names were changed to “P” to protect their identity, other characteristics were included and described in the next table.

**Tab 5.10 Description of the participants**

ID	Geographical Region	Product Category	Position held	Years of Experience
P1	North Central	Agricultural	Top management	4
P2	South East	Automobiles	Middle management	5
P3	South South	Construction	Line management	2
P4	South West	Domestics	Top management	1

P5	North Central	Electrical and electronics	Middle management	3
P6	South East	Food, Drinks and Tobacco	Line management	2
P7	South South	Print and Ink	Top management	2
P8	South West	Steel and Metal	Middle management	3
P9	North Central	Agricultural	Line management	2
P10	South East	Automobiles	Top management	7
P11	South South	Construction	Middle management	1
P12	South West	Domestics	Line management	1
P13	North Central	Electrical and electronics	Top management	5
P14	South East	Food, Drinks and Tobacco	Middle management	2
P15	South South	Print and Ink	Line management	3

### 5.7 Main themes gathered from the interviews

Information collected reveal that there are emerging integrated software solutions providers in Nigeria. These solutions are sometimes not referred to as ERP but according to the participant's description they perform the functions of ERP system. Some of the vendors (Software companies) are local while some are international service providers. The ERP systems are provided in various capacities and prices in this region and the products are usually customised to the user requirements. Although, many of the participant interviewed claimed there is no significant impact of ERP adoption their organisations but also, they identified corrupt practices as the factor impeding productivity and profitability.

Furthermore, as stated by participants in the interviews, Nigeria manufacturing organisations (NMOs) prefer local ERP packages due to affordable pricing. The sub-themes gathered from the interview are enormous but sixteen (16) sub-themes was presented in the four (4) main themes. This was identified and are presented in the next diagram Fig. 5.5 below. The themes are: (1) ERP adoption influencing factors (2) ERP implementation critical success factors

(CSFs) (3) The need to evaluate organisational performance post ERP implementation (4) Recommendations and desirable features for ERP implementation framework. It is important to note that some of the themes and sub-themes exist independently, while others are dependent, typical of thematic analysis.



**Fig 5.5 Emerged themes and Sub-themes from interview transcript**

### 5.7.1 Adoption Influencing factors

The factors that influences enterprise resource planning (ERP) adoption continues to grow as a result extensive finding over the years. ERP benefits include customer satisfaction, cost reduction over time, organisation competitiveness, quality output and increased productivity. The system enhances resource management, planning and pro-active decision making (Gupta, et al., 2018). Several researches have examined and assess the factors influencing the adoption of ERP systems in organisations (Adeboye, 2016; Gupta, et al., 2018). Some findings recognised the ease of user (User-friendliness) , costs of adoption, scalability, and effectiveness on core business activities, as the factors influencing ERP adoption. Though, these studies listed factors peculiar to their findings, but the list can be different or more in other countries.

When the interviewees were asked about “what factors was considered by your organisation before adopting ERP system”. The responses indicated the factors that influenced ERP adoption. The themes that emerged from the transcript’s analysis include, the cost of ERP adoption, ICT infrastructure, management commitment and evaluation of the ERP system effectiveness.

- ❖ **Cost of ERP adoption**: Participants often comment on cost of ERP system adoption during the interview sections. Many of them explained that their limited budget and resources are the major factors that influences ERP system adoption in their companies, respectively.

*“Before we decided to go for enterprise resource planning solution, the management had several meetings, where we thought of many things, ---- yea’ the first thing that we considered was the price” (Interviewee - P01).*

*“To be candid we just had to go for the ERP concept to boost our capabilities. ---- But before now our budget has been the main reason that hindered the company for so long before we finally adopted the system”. (Interviewee – P04).*

*“Adopting ERP system was a challenging decision for the management due to the price or cost involved---- Different vendors presented the concept and it was fantastic, but the problem was the organisation’s budget for such advance technology. But finally cost-benefit analysis justified the adoption. So, the board of directors decided to go for it”. (Interviewee – P07).*

- ❖ **ICT infrastructure**: Participants severally highlighted the need for a sophisticated information and communication technology (ICT) infrastructure as another significant factor that influences ERP system adoption within their Nigeria manufacturing organisations (NMOs). They narrated that ERP implementation is based on flow of

information within an organization. An instance was also sighted that, ERP service deployed over the cloud requires both the cloud provider (Vendor) and the cloud ERP users to have adequate bandwidth with high speed Internet. Lastly, participants stated that lack of ICT skills employees needed to manage the infrastructure hinders the adoption of ERP solutions.

*You see the system is good ooo -----but we don't have staffs! I mean we don't have IT experts to manage it. When the company upgrade the internet bandwidth and changed all the old computers to new ones. The problem of infrastructure reduced but the management still tarried to implement the system because no IT qualified staff (Interviewee - P03).*

*The main issue was the infrastructure, the business was not interest in such solution until it became very necessary for competitive edge. However, the implementation challenge at that time was quality internet service to maintain undiluted real time information (Interviewee - P05).*

However, thirteen (13) of the fifteen (15) interviewees commented about ICT infrastructure to be an important factor that influences ERP system adoption. While the other two (2) did not make any comment on this factor as an influencing factor.

- ❖ **Management commitment:** The management awareness, attitude, and support for advanced information system was mentioned severally by the interview participants. However, a lot studies has identified top management support as high influential towards “Information System” adoption. It was extensive expressed during the interview sections that it is the responsibility of the top management to decide on ERP adoption, to embark on organisational transformation, facilitate ERP adoption, and lead implementation

process. These facts explain the influence of management commitment on ERP adopted.

Some examples of responses are below.

*“When the ERP concept was introduced into the company in 2001 none of the executives was keen about it-----Fast forward to 2014 the ERP system happened to be on the lips of each board member. The entire management interest in this advance system makes it a priority and the adoption decision needed no debate.----The only question was where do we get started”.*

***(Interviewee - P06).***

*“We saw the potential in ERP system and since there was a consensus among the board of trustees, adoption become easy ---- Like the point I am trying to make is that when the entire management agrees on a particular subject it will be accomplished in no time. (Interviewee – P11).*

*“The management have always sort for means to integrate the various processes within the organisation enterprise resource ;planning was the answer to the challenges faced over the years. There was a couple of presentations by vendors but the management was already committed to the concept----- But they needed to make an informed decision on the type and modules that best suit the company (Interviewee – P14).*

- ❖ **System effectiveness:** Many of the interview participants frequently mentioned that they were uncertain about the effectiveness of ERP system over their incumbent standalone systems, respectively. Interviewees mentioned that the substantial amount of money to be spent ERP system, requires a proper evaluation of its effectiveness. Considering the risk involved as a centralised database system managing the core administrative processes, plan, and monitor production. All these factors make ERP effectiveness a crucial adoption influencing factor.

*“Yeah---- as I said earlier, we had wonderful standalone systems in each department, there was no need to change it initially. One of them questions we asked ourselves during meeting about adopting ERP was that “is it better than our current systems”? The comparison and evaluation lingered for three (3) with several vendor presentations---- So there is no doubt that one of the factors we consider before ERP adoption was the system effectiveness”. (Interviewee - P02).*

*“There is a popular proverb that says, “don’t fix it, if it is not broken” So the company initially saw no reason to adopt the ERP system.-----The simple technology we are have been using for many years works very well so change was not deemed necessary. However, ERP system’s effectiveness was evaluated by the competitive advantage it poses from our counterparts that adopted it. Basically, one of the factors that influenced the decision to adopt ERP was the system effectiveness”. (Interviewee - P09).*

*“Hmmm! The moment the ERP concept was initiated the first thing that came to many of the staffs was the system’s efficiency-----everyone was sceptical on its effectiveness compared to what we had at that time. But the software management company was able to convince and demonstrate how effective it is and what impact it could make on the business turn over and customer satisfaction which was very paramount to the organisation”. (Interviewee – P15).*

### **5.7.2 Critical Success Factors (CSFs)**

Critical success factors (CSFs) imply the few things that must happen correctly or must be well managed for a successful ERP Implementation (Nah & Delgado, 2006). The participants responses suggest that in order to implement a successful ERP system, an organization needs to understand the concept and to ensure their business vision is well incorporated. Once again,

an important factor extensive cited was the top management commitment required to maintained enhanced communication. The interview participants mentioned few critical success factors which aligned with other studies such as (Abdelmoniem, 2016; Ngai, et al., 2008; Alharthi, et al., 2017; Bansal & Agarwal, 2015). Top management commitment, Data conversion, Effective project management, Business process re-design (BPR), Staffs training, Change & information management, Dedicated resources, Vendor partnership and support, Project team competence, Suitable package selection, Clear goals and objectives, Effective project management, Communication, Inter-departmental co-operation, Minimal customisation, Knowledge transfer.

- ❖ **Knowledge transfer**: Knowledge transfer describes sharing concepts or knowledge and providing ideas to resolve problems. In organizational theory, knowledge transfer is referred to as transferring knowledge from one organizational sector to another (Nilsson, 2009). This is one of the important tools to minimise risk and to achieve successful ERP implementation. It is apparent from several studies that that unsuccessful ERP implementation reduces customer satisfaction and trust. A production company cannot afford these effects in a market where competition is strong and customer service is the key to every business. Many of the interviewee commented on these facts and couple of examples are presented below.

*“The management of the ERP project did not make provisions for effective information transfer channels during the implementation process to ensure the right information is transferred to the system end-users----- This have hindered us all from interacting effectively with the ERP system and this led to complications” (Interviewee – P08).*

*“The implementation process briefings are done daily, and employees are given the opportunity to participate in the entire process step by step.----- This allowed first-hand*

*informations and effective knowledge transfer. However, learning ability of everyone is different and especially in this northern side to the country where a lot of our staffs are not very educated. So, the management have made it a responsibility of the vendors and consultants to make sure that person centric approach of knowledge transfer is maintain. These really help but we are still struggling a lot because there are lot more aspect of project management that should have been covered". (Interviewee – P12).*

*"We are just eleven(11) months post-implementations but the problem for me personally is that----- I am worried at the rate everything changed, and it seems my other staffs feels the same. We are unable to ask questions and the information transfer is not adequate considering the fact that it is a new way of working. I believe one of the mistakes was the improper ERP implementation process, such that internal staffs were not involved at the initial stage, so it all became complicated and the consultants were not able to transfer information accordingly to every staff's understanding. Although, we are still able to use our old system, but I wonder what will happen when we completely migrate" (Interviewee – P13).*

- ❖ **Change management:** Managing changes is a factor seriously influences how stakeholders cope with the changes during ERP implementation. Change management dictates the degree at which the employees cope, this can either have a positive or negative emotional influence. According to Fugate, et al., (2008), if organisations are able positively influence employee's ability to cope with organisational changes it would possibly facilitate a successful ERP implementation. However, it is important to note that everybody possess their own baseline of resistance or openness to the change. While communicating changes is important to study the audience abilities. The participants comment about change management is represented below.

*“One thing that is important to achieve a successful ERP project is the ---change management---, the transition from one system to another is a very delicate process that requires effective project management. In our organisation we tried to manage our strategy to reflect continuous improvement on how thing is done. However, the overall ERP project management is not terrific enough”. (Interviewee – P04).*

*“There are a lot of CSFs but as I said earlier change management was one of the crucial factors. I believe there should be a continuous training and development programme for staffs before, during and after the system implementation.-----Individual suggestion and concerns should be taking seriously during briefings. I believe the management also need to take it upon themselves to map all process change and made this available to everyone. The ERP improper project management hindered the success rate of the system”. (Interviewee – P10).*

*“I will say the lesson learnt from our recent ERP implementation is how critical it is to manage the process and cultural changes-----The way things are done changed completely and we all struggled to relate to the new system environment. The company is already looking into going back to the old system temporarily in order to management the changes fundamentally. I believe the entire project management is terrible” (Interviewee – P14).*

- ❖ **Top management support:** These means the extent to which the management of an organisation offers direction and resources during and post ERP implementation systems. Top management support and commitment drives other organizational members positively and appropriately. On the other hand, lack of support from top managers in an ERP implementation can be catastrophic. Several studies on ERP systems, has identified top management support as a critical success factor for ERP projects (Davenport & Short, 1990; Somers & Nelson, 2004). Therefore, top

management support can be instrumental for the overall success of the ERP systems even at the post-implementation stage. The implementation success is great, when there is a unified backing and dedication from top members of the various functional units is involved.

*“Well, I think it goes without saying that without the full support of the management ERP implementation cannot thrive-----The management plays a very important role. They managers of different functional units are to present a team representation for their department. Take for instance, our organisation had to wait a whole year to gain a general consensus of all the departmental head who believes there was no reason to adopt ERP. The lack interest and commitment affected the ERP project management negatively.-----Therefore my opinion about critical success factor is the management commitment. (Interviewee – P04).*

*“Honestly I will say the kind of energy the management put behind ERP adoption gave the entire organisation a positive moral about the system----- It was described to us as a complete solution the our logistics challenges and inventory management issues. So, the influence of the top management prepared everyone’s mindset toward using the new technology. However, this is my opinion, some of my colleagues still have concerns about the entire project management” (Interviewee – P07).*

*“My opinion as a manager is that the success of projects such as ERP implementation is tied to how committed the top management are----because somehow the level of commitment will infiltrate through the organisation, which will result in entire organisational commitment. We have a serious project management issues because there was no structure and mapped direction due to lack of commitment (Interviewee – P10).*

- ❖ **User satisfaction:** User's satisfaction is very critical to ERP implementation success and it can be measure by the users' willingness to use the new ERP systems. No matter how fantastic a technology can be, if it is not easy to operate or user friendly it is useless. Graphical user interface (GUI) friendliness is an effective measure of user satisfaction. It serves as the contact point for interacting with systems. The ease to navigate, assign and complete task increases user's satisfaction which will eventually lead to enhanced productivity. The level of satisfaction or dissatisfaction derived from an ERP graphical user interface is critical to ERP implementation success. Several studies have discovered that application GUI is a significant variable of ERP end-user satisfaction.

*"I believe that one of the ERP implementation most critical success factor is the user's satisfaction---- The user interface goes a long way to impress the system users. The ease of operation and friendliness of a system results in user's satisfaction and other way round will result in dissatisfaction. Other factors that hindered user-satisfaction is our organisation is lack of adequate training and lack of effective project management ". (Interviewee – P05).*

*"This organisation has now adopted three(3) different types of enterprise systems. Although, the previous ones are standalone for different departments, but they were all later abandon due to complexity and user dissatisfaction. The present ERP system in use is user friendly, less complex but very easy to manipulate for corruption practices. ". (Interviewee – P08).*

*"In my opinion user friendliness matters a lot, the management decision to adopt ERP involves selecting an easy-to-use system.-----Because there will be no point if even the system is fantastic but cannot be used effectively due to user's dissatisfaction. This was the main concern within our organisation. The staffs are not able to use the effectively, hereby hindering performance, but the good side is data became difficult to manipulate in case of fraud".(Interviewee – P10).*

### 5.7.3 Business Performance evaluation

Business performance evaluation can be defined as the extent to which ERP implementation efforts achieves an organisation primary and secondary performance objective (Althonayan & Papazafeiropoulou, 2013; Hongyi, et al., 2015). Several research studies have been done to determine the link between Organisational Performance on business performance. According to these studies there are different measures of performance, these include financial and nonfinancial performance, corporate performance, business operational performance, and quality performance. This research finds identified few business performance evaluation dimensions such as business profitability, organisational growth, Viable Competitive edge, and Customer Satisfaction. According to the interview findings some of these measures are achieved by businesses except business profitability which seems to be insignificant. The interviewee expressed their concern about corrupt practices and data quality as the main obstruction to business profitability.

- ❖ **Business profitability:** Organisations remains in existence by making profits and reducing expenditures in their industrial operations. Reducing cost and increase profit in the Nigeria manufacturing environment requires effective inventory control and supply chain management. Also, providing a good customer's service to enhances the level of customer satisfaction and patronage was discussed. The participants explain their rationale behind profitability as directing the staff and urging them to be more enthusiastic towards the success of ERP adoption to ensure the effective implementation and evaluation of aftermath effect the performance. ERP implementation should improve an organization's turnover over a period compared to the competitors. Some of the area expected to boost the economy of an organisation are return on corporate investment, return on sales and organisation's return on assets (ROA) also improves. An organisation's liquidity cash flow position

improves as well. On the contrary many of the interview participants sees the profitability performance factor differently due to various types of corrupt practices discussed below

*“Enterprise resource planning system works really fine but in terms of profitability I will say the turn-over remains the same-----there are no significant changes at all. Don’t get me wrong it is fantastic in other aspects, but profit margins remain insignificant and I believe it may be as a result of corruption practices”. (Interviewee – P03).*

*“In this aspect there are a lot of things to say but I won’t say much, there are intentional double-dealing and fraudulence that exists before the adoption of ERP system-----This things cannot be changed by ERP system. Take for instance data can be manipulated even when it has earlier been registered initially to say the least” (Interviewee – P05).*

*“I really wonder if ERP system can be improved to track edited figures because to be honest even the finance department can be corrupt. I know for a fact that there is definitely huge customer satisfaction and increased sales, but I can bluntly tell you that no significant profit has been recorded since ERP adoption”. (Interviewee – P09).*

❖ **Organisational growth:** ERP implementation improves business environment dramatically. ERP brings a level of automation to the company, which enables staffs across the organization to access shared information in real-time without the need to retain manual data. Improved workflow where processes are streamlined with a user-friendly interface. Repeated data, which can lead to discrepancies and production line downtime are eliminated. This is a common problem in manufacturing organisations with multiple data storage ERP system enable staffs to obtain the appropriate information that is necessary to do their job. ERP system makes job easier and leads to increased productivity.

*“We have seen quite a number of growths in the organisation, ERP system simplifies tasks and workload on staffs by automation. ---- The system provides enhanced information management and also display performance metric are available which represents progress made”.*

**(Interviewee – P09).**

*“Since we adopted the ERP system, we have seen improved workflow in all processes. There is access to real time information, data security and integrity. Strategic informations can be access strictly by whom it may concern. Business information is maintained in a central database system where updates are done and authorized in real time to enhance management strategic decisions”. (Interviewee – P11).*

*“It is quite difficult to classify growth in a single context. When we look at varieties of aspects such as faster management decision, complete overview of the organisation production process, employee’s development, and competition yes, we are growing-----Hmmm! But when we consider the expected rate of return (ROI) we still have challenges with quality of data input into the ERP system this is affecting our inventory and finance. (Interviewee – P13).*

❖ **Viable competitive edge:** Organisations invest in ERP system to achieve certain goal and develop specific capabilities to improve the managerial and technical competencies. ERP system add value to an organisation towards a long-term benefit. ERP systems implementation simply lead to direct and indirect benefits because it facilitates business growth by accelerating innovations and effectiveness. All these create value and opportunities that could ultimately result in competitive advantage. Also, the participants highlighted that such advantage build an organisation’s reputation, expand the vision, and better managerial coordination. Interviewees added that the overall awareness of competitive strength of an organisation increases staff’s commitment. All these factors

transform the internal benefits of implementing ERP into external reputation and more competitive advantage.

*“There is nothing like confidence. It is not enough to have a good product---An organisation needs to maintain a good reputation and also sell more product to keep the business running. The kind of competitive edge ERP system gives to our organisation is tremendous. The CRM is superb, our customer base increased, and our product is rated as one of the best around”*  
**(Interviewee – P01).**

*“The major business growth we have seen is the competitive edge. Although our organisation was doing well before ERP system, but decision making is a very slow process-----Other companies gets things done faster than we do. But with the current system ERP, the management gets a real-time information and makes fast and effective decision”.* **(Interviewee – P04).**

- ❖ **Customer satisfaction:** Satisfying customers efficiently can be a challenging task if you have a standalone system managing customer and inventory data on different platforms. An instance was narrated by one of our interviewees about situations when you will have to present a product related information to a customer, and you slightly missed the updated inventory information, this could be devastating. The ERP system impact on customer servicing was positive expressed in terms of maintaining updated information in real-time. This enables customer service representatives (CSRs) to provide updated and accurate data to customers competently. This interview questions are designed to understand the improvement in customer satisfaction from the staff’s view. The interviewees discussed about reduced customers’ complaints and retrieval of churn/lost customers with positive feedbacks on customers relationship management of their organizations, respectively.

*“The statistics of Organisational Performance on performance especially handling of customers information with ERP has been fantastic-----with simplified processes, automations self-service support, reduced transaction time, has increased our customers satisfaction”.*

***(Interviewee – P03).***

*“In terms of performance evaluation, evidence shows that the stakeholders, staffs and managing executives concurred that there is value added from the operational activities that led to customer satisfaction and overall improved business performance”.* ***(Interviewee – P05).***

*“ERP system massively influenced our business processes, operations, and the overall organisational performance. This impact was evaluated by the development of services provided internally by our customer service section----- and customer satisfaction evaluated form their feedback and less complains”.* ***(Interviewee – P15).***

#### **5.7.4 Recommendations/Desirable features**

Participants were asked series of interview question towards the re-design of ERP system to suit the Nigeria manufacturing environment. Corruption practices was a well-known fact especially in the inventory management and financial department. The adoption of ERP has been quite efficient for various reasons of adoption but there lies the issue of data manipulation and data quality. Also, due to infrastructural inadequacies in this environment such as power cut and poor internet connectivity. The organisation will have to rely on its “database” which is a single point of failure (SPOF) and offline backup which will be non-real-time. The perpetrators had identified these loopholes to carry out untraceable transactions and malicious activities. These acts directly affect the maintenance of quality data due to issues with system update. This cycle continues for a long time and defeats the whole essence of substantial long-term turn-over (profitability). Based on the identified points above, the themes gathered from the interviewees responses are divided into three aspects described below:

- ❖ **Seamless integration:** Based on the information collected from the participants about their incumbent information systems before the ERP package. Implementing an integrated information system such as ERP system brought a radical change in their organisations, respectively. However, the general theme shows that many of the organisations encountered major challenges during the transformation processes and this hindered a breakthrough performance. It was suggested that a seamless integration framework should be developed and constantly improved upon.

*“I believe the challenges we face is due to not having a seamless integration during the automation of our modules inventory, manufacturing, purchasing and finance.---- This might have enabled us to have a healthier purchasing relationship with our shun customers”.*

***(Interviewee – P05).***

*“There was obvious negative effect during ERP integration process-----An instance is when raising a sales order, the sales department manually sends a copy of sales order to the production. Manufacturing department sent a request of BOM to inventory to ensure they had enough components for production”.* ***(Interviewee – P10).***

*“We encountered the issue with integrating automation and manual operation. There was not smooth integration of the automated activities. For instance, when a sales or order is made ERP system creates a new data record for customer and suppliers. However, when a staff in the sales department creates a sales order, the production and finance department are automatically notified of the new sales request. The Manufacturing module calculates the bill of material and sends a copy to inventory department. In this chain of activities some automation still needs manual intervention due to non-seamless integration”* ***(Interviewee – P11).***

- ❖ **Ease of use/User friendly:** It is important to note that a lot of employees in Nigeria manufacturing organisations are not conversant with technology. Moreover, one of the severally recommended features in Information technology for this part of the world is the user-friendliness. The participants that already adopted ERP system complaints about the interface complexity and navigation ease. The user interface or (GUI) needs to be very 'friendly to the user. Participants explained a typical user may know nothing about the multiple functionalities of a software what they care about is the functions they need to carry out their daily activities and ease of use. The will to use a system depends on the way they interact with the computer interface. It should make use of simple pictures, graphics, and icons they can relate easily. Thus, the essence of so called 'graphical user interface (GUI)

*“Thank you for asking these questions--- my opinion about recommendations and strictly is about the complexity of ERP. Many of our staffs complains on how difficult it is do their daily activities. The system is average good, but it is too complex for my liking and I believe am speaking the mind of other staffs. I will say that operations summary videos will be very helpful maybe for FAQ because even some of the top management don't know and they are unable or unwilling to ask subordinates.”. (Interviewee – P04).*

*“I receive a lot of internal feedback form staffs about the complexity of ERP system--- The system is too sophisticated for these guys. Infact we've had to call him the supplier(vendor) few times when our in-house IT staffs cannot solve the issues. I believe a more user-friendly interface will do better. Also, anonymous feedbacks, question, and answer portal for those that are too timid to ask questions openly. (Interviewee – P06).*

*“We are yet to adopt ERP system but from the research we have seen that the system can be complex to navigate depending on the vendor---- The management essential priority is to make*

*sure we invest rightly. So, we are working on getting a user-friendly ERP system and I will strongly recommend this for any organisation with the intentions of adopting ERP system.*

*(Interviewee – P11).*

❖ **Data security and Trust based:** There is a very high level of dishonest and unscrupulousness practices at every level in any organisation in this part of the world. Deceit and fraudulence misconduct reigns in every level of management. Hence, participants explained that corruption practices have been one of the main reasons for non-profitability. Secondly data security and data manipulation were mentioned alongside system trust. Participants explained that there is need for extra features protecting ERP data hereby building trust. Interviewees stated that this matter should be taken seriously as data security, data traceability and transparency should be a key priority in ERP system adoption.

*“Enterprise resource planning (ERP) system is good but with the level data manipulations going on business especially in inventory and financial management, it is difficult or rather impossible for ERP system to transform or create significant profitability for the organisation. There should be a self-audit feature that can detect malicious changes and flag malpractices”.*

*(Interviewee – P06).*

*“The adoption of ERP system brought about process automation and management efficiency. But the concept of centralized data based is a big concern, because it is a single point of failure.--- Data manipulation can be done from the central database and as a cogent part of the ERP system if it fails, the entire system will be affected”.* **(Interviewee – P11).**

*“I will suggest a highly data secured and trust-based ERP system-----that will fit this environment. We have seen several cases of corruption practices and data manipulation before*

*and after ERP implementation. I think to achieve a data quality, there is a need for a trust-based system". (Interviewee – P14).*

### **5.8 The result interpretation for quantitative and qualitative findings**

In this study, the qualitative and quantitative data were separately analysed and integrated using the mixed method of concurrent triangulation design. According to Guetterman, et al., (2015) this approach is considered to be appropriate when there is need to acquire different but complementary data on a particular subject matter within the same timeframe. As stated earlier, the triangulation design is a single phased design where quantitative and qualitative data collection are carried out within the same timeframe and with equal preference. In other words, it is concurrent, but separate data was collated and analysed in the quantitative and qualitative method for clearer knowledge of the research problem. The two data sets result are combined, usually by gathering the separate results together during interpretation.

To enable integration of the two data types in the analysis, the quantitative findings present statistical expressions the extent of ERP system adoption within the NMOs, adoption influencing factors, perceived benefits, and critical success factors within the Nigeria manufacturing organisations. While the qualitative findings provided further and in-depth information of the quantitative findings, including the influence of ERP on business performance and participants recommendations towards the desired features on ERP implementation improvement.

### 5.8.1 Interpretation of research findings against the literature

According to the aim of this study, which is to enhance the Nigeria manufacturing organisational performance. The literature review in this studies considers what is known about Nigeria Manufacturing Organisations (MNO), ERP adoption and its critical success factors for Nigeria manufacturing organisations. Despite the increased adoption of advanced information technology systems, the literature shows that Nigeria manufacturing organisational performance is quite low. Therefore the research findings identifies area of improvement for ERP re-design. Below are the list of improvement that can be made in ERP implementation as identified by the research findings;

- ❖ Improved ERP project management.
- ❖ Corruption practices mitigation using a “Trust based ERP system”.
- ❖ Adequate performance measurement
- ❖ Information/Data security.
- ❖ Increased seamless integration.

However, there are similarities in the research findings and the existing information the the literatures, which are presented in the table below.

**Tab 5.11 Similarities in the literature and research findings**

<b>Factors influencing ERP adoption</b>	<b>Critical success factors</b>
Cost of Adoption	Top management committment
IT Infrastructure	ERP Data quality
Top Management awareness	ERP users’ efficiency” (staff’s skills and training),
Business Size	ERP ease of use,
Government Policies	ERP fit for organisation
Knowledge transfer and communication	ERP Project and change management.
Work ethics & Culture	User-Satisfaction and feedbacks
	Vendor Partnership and continuous support
	Seamless Integration
	'Cultural change readiness'

### 5.8.2 Interpretation of the first four research questions (quantitative findings)

Studying the level of information technology adoption such as ERP system within the Nigeria manufacturing organisation (NMOs) gives an insight to the research problem. However, merely going ahead and investing in ERP systems is not enough to solving the problems of any organisation within the Nigeria's manufacturing sector. The process requires much more effort such as understanding the critical success factors, different factors that lead to ERP adoption and so on. To achieve the aim of this research that is to "investigate the adoption of a re-designed ERP system towards enhance productivity within the NMO". There is need to sort out the research questions in this study. Some of which was answered in the quantitative analysis.

Q1 - What is the degree of ERP system knowledge within the Nigeria Manufacturing Organisations?

❖ **Interpretation:** The common knowledge of Information technology (I.T) adoption within the Nigeria Manufacturing organisations is changing rapidly. Although, there are several categories of barriers that hindering the adoption of advance I.T, but according to the quantitative findings of this study that made use of information from six (6) different regional parts and three hundred and fifty (350) sample of manufacturing organisations. More than thirty-five (35%) of the sample size adopted an integrated information system such as Enterprise Resource Planning ERP. These organisations were randomly selected from the data obtain by Manufacturers association of Nigeria (MAN). Therefore, generalizing the findings into the entire population reflects that considerable number of organisations adopted ERP system.

The level of ERP knowledge was based on the years of experience of the survey participants and knowledge level ranging from Beginner, Intermediate and Expert. Enterprise resource planning knowledge is not expected to be massive. According to the data collected six (6%) of the participants possess with 5-10 years of experience, while the rest have four years or less. The generalization of this data implies that ERP system knowledge is moderate and still growing. However, it is important to note that Enterprise planning knowledge will massively impact knowledge transfer.

Q2 - What are the most challenging functional units within the Nigeria Manufacturing Organisations?

❖ **Interpretation:** Findings showed that Inventory management, supply chain and the financial accounting departments are the most challenging units to manage within the Nigeria Manufacturing Organisations (NMO).

Q3 - What are the factors influencing ERP adoption within the Nigeria Manufacturing Organisations?

❖ **Interpretation:** The factors that influences ERP adoption was view from the perspective of ERP user and non-users. For the ERP users, these are the factors that influence the decision to adopt ERP software. These factors are based on ERP advantages such as Inventory management, Unified database access, Supply chain efficiency, decision effectiveness, Job satisfaction, Competitive edge, and primary profitability. While, On the other hand of the non-ERP users the significant factors hindering ERP adoption include Adoption Cost, Skill and literacy, Management Commitment, Business size, Information Awareness, IT infrastructure, Trust and Reliability. The data collected reflects that cost of adoption, Trust, reliability, and awareness are the major factors influencing ERP system

adoption. However, for ERP users Inventory management and profitability appears to be the major factors that influenced ERP system adoption.

Q4 - What are the critical success factors (CSFs) ERP system implementation within Nigeria manufacturing sector?

- ❖ **Interpretation:** Critical Success factors (CSFs) can be described as what needs to be done for a satisfactory result throughout ERP life cycle, to ensure competitive performance of the organization. The analysed information focus on success factors of ERP implementation to help achieve organizational performance. The research participants indicated critical success factors according to their personal experiences. These factors include Staffs training, Trust, reliability, user satisfaction and Change management. Therefore, these are areas should receive constant attention from management. In order words critical success factors (CSFs) can be highlighted as set of factors that the management should considers critical to the success of the business.

Continuous staff training ensures all staffs are confident and effectively discharging their duties. Trust and reliability can be from the various sources such as data quality, database security and so on to prevent corruption practices and customer dissatisfaction. User satisfaction reflected severally in the survey because ERP users considered factors such as user-interface, system complexity/simplicity and so on. The fourth weighted factor is the change management which appears to be huge responsible of the management. The seamless integration of ERP and managing staff's resistance to change can be very crucial to success of the ERP implementation.

### **5.8.3 Qualitative findings Interpretation and research questions discussion**

The qualitative research findings reflect a deep insight into the data collected from the quantitative findings. The qualitative study answered two of the research questions and gave

comprehensive perception of the concerns of the ERP users towards business performance and recommendations for suitable ERP features for the Nigeria manufacturing environment.

Q3 - What are the factors influencing ERP adoption within the Nigeria Manufacturing Organisations?

❖ **Interpretation:** There are several factors highlighted by the research interview participants. The most frequently mention factors that influenced ERP adoption was divided into four (4) components. The first is the “Cost of ERP adoption”, due to the cost of enterprise resource planning software many organisations debate its adoption in terms of cost to ROI and opportunity lost. However, many ERP vendors providing cloud-based ERP system makes it a little bit affordable for some organisations considering their size and actual need for the system. Next is the “IT infrastructure”, the common issue of internet across the country makes technology adoption very difficult. Some of the participants explained that for them to maintain the real-time access to the ERP system they had to rely on multiple internet providers which leads to more cost.

The third aspect was the “management commitment”, there are many organisations that was long overdue to adopt a new information technology but due to the management enthusiasm it delays for so long. According to the participants knowledge and awareness matters so much. For instance, some staffs have the knowledge of ERP but no decision power while the top management that has the decision power lack knowledge of advance IT such as ERP. And lastly the “system effectiveness” this is another important consideration of the among the factors that influences ERP adoption within the Nigeria manufacturing organisations. According to a particular participant who stated that “why fix if not broken”. Some organisations have an incumbent system in place which will be radically affected by the ERP system. Therefore, ERP effectiveness compared to the old form of operations influence ERP adoption.

Q4 - What are the critical success factors (CSFs) ERP system implementation within Nigeria manufacturing sector?

❖ **Interpretation:** This appears to be the most crucial part of ERP system adoption. Because unsuccessful system adoption can make a business go bankrupt. Hence, according to the findings which was spitted into four(4) components. Firstly, “Change management”, managing change was severally mentioned as critical to any new system implementation. The employees a typical manufacturing organisation are conversant old practice, hereby making it extremely difficult to change radically. Especially, when it involves complex and advance information system. Some of the participants explained that staffs find it difficult to navigate the ERP system and its functionalities, whereby resulting in customer dissatisfaction. Next is the “knowledge transfer” apart from training, participants explained that there should be sharing of knowledge during briefing and meetings towards lessons learnt and action plans. Knowledge continues to grow with experience on ERP system, therefore, the knowledge needs to be transferred on to others for efficient workflow.

The participants also explained that knowledge transfer should be comprehensible in the language that the users understand. The knowledge transferred should be focused on problem solving and change effectiveness rather than information memorization. To interpret further, there should be no isolated facts instead an organised knowledge structure about ERP system should flow from project champions to the users directly. When the semi-structured interview questions were discussed face-to-face with the research participants. The participants revealed positive perceptions about the importance and benefits of the ERP system. However, the interview participants immensely express their concerns about ERP implementations. There were four(4) major themes gathered form the interviews, which was further sub-divided into sixteen(16) other components. The first two

themes were discussed above while the following discussions represents the last two themes generated from the qualitative study.

❖ **Business Performance Evaluation:** The study critically evaluates the impact of ERP system adoption within the manufacturing organisations. It is important to note that the critical success factors (CSFs) highlighted previously in the themes have a strong connection with the overall organisational performance. The components evaluated include Customer satisfaction measured from feedbacks and number of complains. The interpretation of the interviewee's response is the overall increase in customer satisfaction after ERP adoption. Also, for the competitive advantage of ERP adopting organisations, the participants highlighted positive impact of ERP system on their organisations respectively depending on the effectiveness of the CSFs.

However, the organisational growth and profitability, according to the findings appears to be a huge concern among the organisations due to corruption practices within the organisations. Almost, all the participants highlighted that the Inventory and the finance department continues to be a massive impacted by corruption despite ERP adoption. Some of the participants explained in details of several fraudulent activities within the inventories and finance. The discussions and evaluation interpret that the best feature of ERP system (Central database) appears to be the single point of failure due to data manipulation.

❖ **Recommendations and desirable features:** There are few recommendations that the interview participants believe could make ERP system suitable for the Nigeria manufacturing sectors considering the challenges inherent with its implementation. Although, the perceptions of the interviewees are different but the frequently mention factors are interpreted. Firstly, the “data security” data quality of the ERP system was discussed. Participants indicated that due to ERP implementation challenges such as

internet and electricity, many of the information are not in real-time. This reason makes data subjected to human manipulations and also ERP database is identified as a single point of failure.

Secondly, integration process and disruption were severally mentioned. The process of integrating ERP system was a lesson for many of the organisations due to the interruption of their daily activities. Participants suggested that “Seamless integration” will go a long way to successful implement ERP system. Thirdly, user-friendliness was mentioned in various terms such as ease of use simple user interface and so on. Due to the level of skill and literacy within the Nigeria manufacturing organisations, it is important to have a very user-friendly ERP system. The fact is some organisations had to reverse to their old system due to ERP complexity after investing so much on its implementation.

The last recommendation was a trust-based ERP system which can be corruption proof. Many of the participants explained this fact in various forms such as self-auditing ERP system, immutability and so on. All of the suggestions point towards a trust-based system. According to the words of a particular participants “ The purpose of adopting and investing so much in ERP is for business growth, so its performance should fit our expectations in a corrupt environment.

#### **5.8.4 The quantitative and qualitative Interpretations**

The finding of this research both quantitatively and qualitatively have a trend of similarities with more insight revealed with the qualitative studies. It was an eye-opening experience to explore the research problem using a mixed method because some of the finding would have not been well understood with a single approach. The quantitative findings revealed the relationships between independent and dependent variables. This followed by identifying the

factors affecting the adoption of ERP within the concise of the questionnaire survey. The critical success factors were later identified and listed according to the findings of the survey.

The qualitative findings correspond strongly with the quantitative findings followed by more insight to the research problems while investigating the implementation of a re-designed enterprise resource planning systems. The prominent similar factors influencing ERP adoption identified below.

- ❖ Cost of ERP Adoption
- ❖ IT Infrastructure
- ❖ Management Commitment
- ❖ System Effectiveness

While similar critical success factors (CSFs) identified include.

- ❖ Change Management
- ❖ Knowledge Transfer
- ❖ Top management commitment
- ❖ User Satisfaction

The factors that hinder ERP successful impact on organisational performance include:

- ❖ Improper project management
- ❖ Corruption practices
- ❖ Inadequate performance measure

Recommendations and desirable features include

- ❖ Data security
- ❖ Seamless integration
- ❖ Ease of use/ user friendliness

❖ Trust based

## 5.9 Conclusion

This chapter has shed light on the findings from both the quantitative and qualitative phases of this study. In the qualitative phases of the study, data was collected from fifteen (15) participants in a semi-structured interview. Thematic method was used to analyse and interpret the data obtained. This was a means to completing the triangulation mixed method, shedding light on the quantitative and giving the participants to express themselves extensively in a semi-structured interview. There are four (4) main themes that were identified from the interview transcripts namely: (1) ERP adoption influencing factors – this factor influences the decision to adopt ERP in an organisation. (2) ERP implementation critical success factors (CSFs) - considering the huge number of failed ERP implementation, it becomes imperative to look into the success factors. However, the findings in this research agrees with the fact that many of the organisations that did not achieve the improved result they seek are due poor or improper implementation. (3) Identified business performance evaluation as a result of ERP implementation (4) Recommendations and desirable features for ERP implementation framework.

Majority of the participants are responsible for ERP development or deployment in their organisations as a head or top management member, respectively. They all understood the need to contribute towards ERP development to suit the Nigeria manufacturing environment. In summary the major challenge that hinders ERP's impact on organisation performance i.e., productivity and profitability is the incessant corruption practices within the Nigeria manufacturing organisations. A very good example is an information discussed by one of the research participants who explained that a government owned manufacturing organisation even after adopting ERP system in 2015. There was an audit after four years in 2019 only to realise

that the organisation had expenditures but there was no income at all. The entire production system only incurred expenses without any revenue from the product manufactured.

## CHAPTER 6

### ERP FRAMEWORK RE-DESIGNED

#### 6.1 Introduction

The previous Chapter examined and analysed the data collected via questionnaire survey and a semi-structured interview within the Nigeria's manufacturing industry. The data analysis suggests what needs to be modified and the development of re-design conceptual framework of ERP implementation in addition to that presented in chapter three. This will be a proposed re-design of the ERP implementation concept. This chapter discussion will elaborate and modify ERP implementation framework to suit the Nigeria manufacturing sector. This research work satisfies the aim and objectives of this thesis. Which is to propose a re-designed ERP implementation framework for Nigeria's manufacturing organisations (NMOs).

Re-design is based on the research findings about ERP adoption influencing factors, Implementation critical success factors (CSFs), evaluation of business performances and recommendations of desirable features from the research participants. To achieve the aim of this chapter, this study proposed blockchain technology that can be integrated with ERP system to improve various aspect of the organisation, most especially internal finance, inventory and the overall supply-chain. This chapter explains the advance framework of blockchain ERP (B-ERP). The proposed ERP implementation redesign is mainly for manufacturing modules such as production, inventory, and financial management suitable for the Nigeria manufacturing organisations. The study may offer stakeholders, academics, and practitioners an ERP adoption and implementation reference for other Nigeria sectors.

This research examines blockchain technology integration with the ERP software towards a track and trace management system in Nigeria's manufacturing sector. The blockchain technology uses a distributed database, which is the technology behind the in-built trusted

digital currency transactions (Monk & Wagner, 2013). The major segment of advancement is the reduce reliance on a single centralized data storage. Every information is distributed between interconnected blocks, which are joined into a chain using confounded algorithms. Each block stores it's very own snippet of information. New blocks can be added to the finishing of the chain, yet they cannot be altered after including it.

A typical believe is that blockchain technology is constrained to the monetary world but blockchain potentials are a lot more extensive, it is vast and it might change the manner in which the business operates, just the way assembly line transformed manufacturing during industrial revolution. There is various ongoing research by ERP vendors who intend to integrate blockchain innovation to enable organizations deal with their daily activities. This research will serve as a reference point for Nigeria manufacturing enterprises that wants to tackle corruption practices. It presents an immutable real-time information and maintains self-audit records of modules such as inventory, finance and so on (Parikh, 2018). Integrating ERP software with the blockchain technology will allow quick data checks and produce higher reliability.

## **6.2 The proposed ERP implementation requirements for the NMOs**

Manufacturing organizations benefit enormously from a successfully implemented ERP system. Especially when it is seamlessly integrated into the heart of manufacturing operations (Saeed, et al., 2012). Some of the roles of ERP system is enhancing organisation's effectiveness, reduce costs and enhance the overall quality of production. Therefore, result in increased revenue due to customer satisfaction and patronage. Also, businesses require changes in organisational operations and processes to accommodate expansion. On the other hand, when an organization is unable to meet a certain level of customer's expectation, it results in customer dissatisfaction, diminishing reputation, and revenue reduction.

Therefore, manufacturing organisations are encouraged to adopt efficient ERP framework and parameters when selecting modules and vendor that can satisfy the constantly-changing needs of their organisation. Also, considering the business size and resource funds available to organisations, respectively. It is important to use an effective implementation framework that will ensure benefits realization. The Nigeria manufacturing organisations (NMOs) are mostly small and medium in sizes. Therefore, it is imperative to manage their limited resources when implementing ERP system. Adopting an all-round effective deployment standard with quality comparable to a large organization.

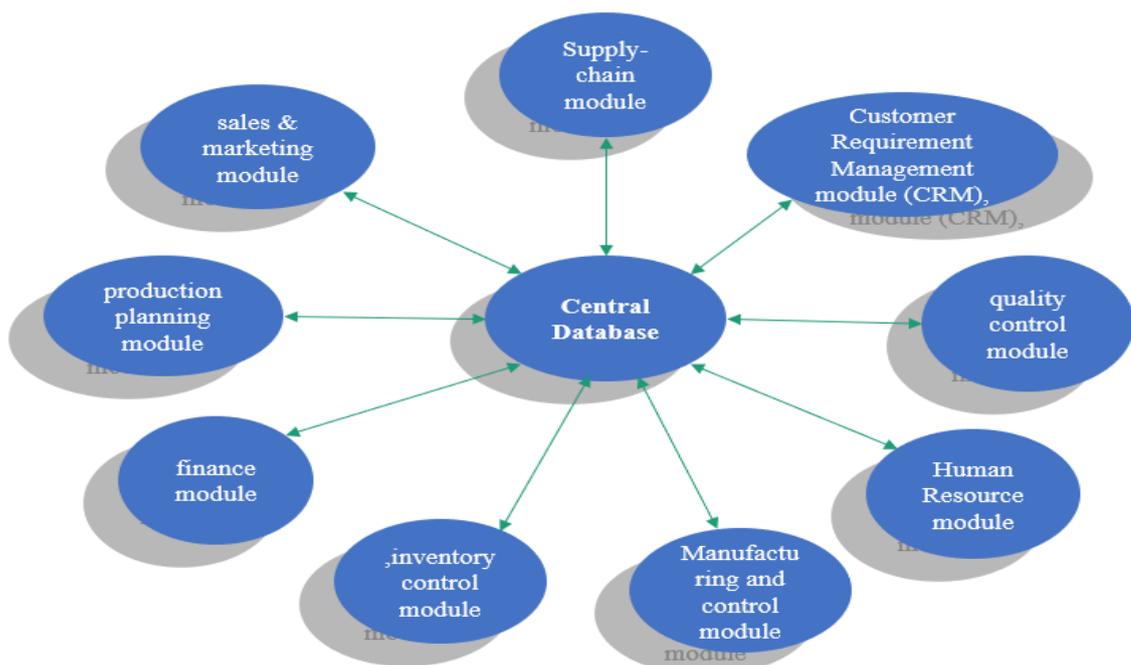
Although, many vendors now offer economical ERP solutions, but if the implementation fails some organisations cannot recover. An unsuccessful system adoption and implementation can have grievous implications on an organisation. Such as loss of market share and ultimately bankruptcy. However, despite the urgent need of ERP systems, the risks involved cannot be understated. There is limited research on how to assist manufacturing organisations in Nigeria with a suitable ERP implementation framework. To increase the chances of benefits realization, this research propose and incorporates a lean six sigma project tools before and during implementation, a continuous balanced scorecard performance measure post-implementation and an immutable distributed ledger known as blockchain technology as underlay to support the ERP system framework.

## **6.3 The redesign model for ERP adoption and implementation**

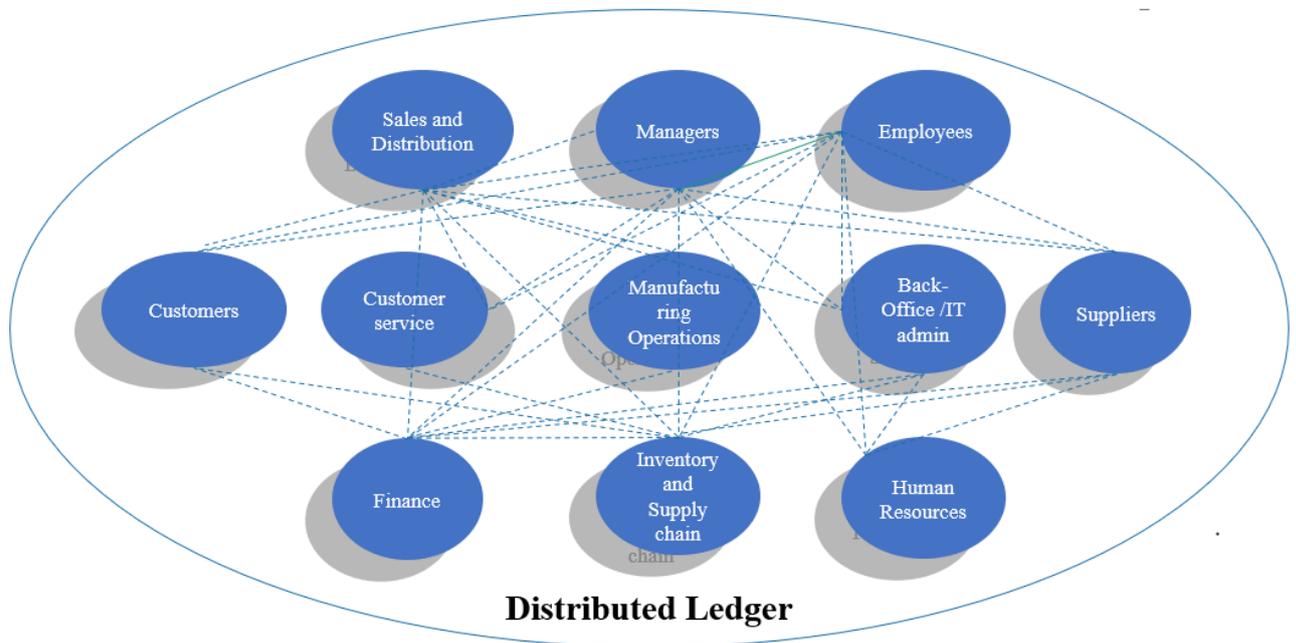
### **6.3.1 Blockchain Technology**

Considering the pragmatic research findings shown in chapter Five (5) of this study. The research introduces are re-design by modifying the conceptual model in previous chapter. This research has previously assessed the factors influencing ERP system adoption and the implementation critical success factors in Nigeria's manufacturing sector. Based on the research findings and participants recommendations this chapter proceeded by recommending immutable distributed ledger also known as blockchain technology as an underlay to support the ERP implementation framework in this study. This is purposely designed to suit the environment in question (Nigeria's manufacturing sector).

The intention is to create a decentralized database, automated audit, and a trust-based environment. Hereby, increasing the chances of ERP technology adoption and implementation. Taking ERP benefits discussed in various sections into consideration. The proposed re-design Blockchain Enterprise Resource Planning (B-ERP) covers many features and attributes in the conventional ERP design. A diagram representation of centralized database ERP and a conceptual framework coupled with data flow diagram of B-ERP presented in this study is illustrated in Fig 6.1 and 6.2 respectively below.



**Fig 6.1 Conventional ERP with centralized database**



**Fig 6.2 B-ERP conceptual framework with de-centralized database**

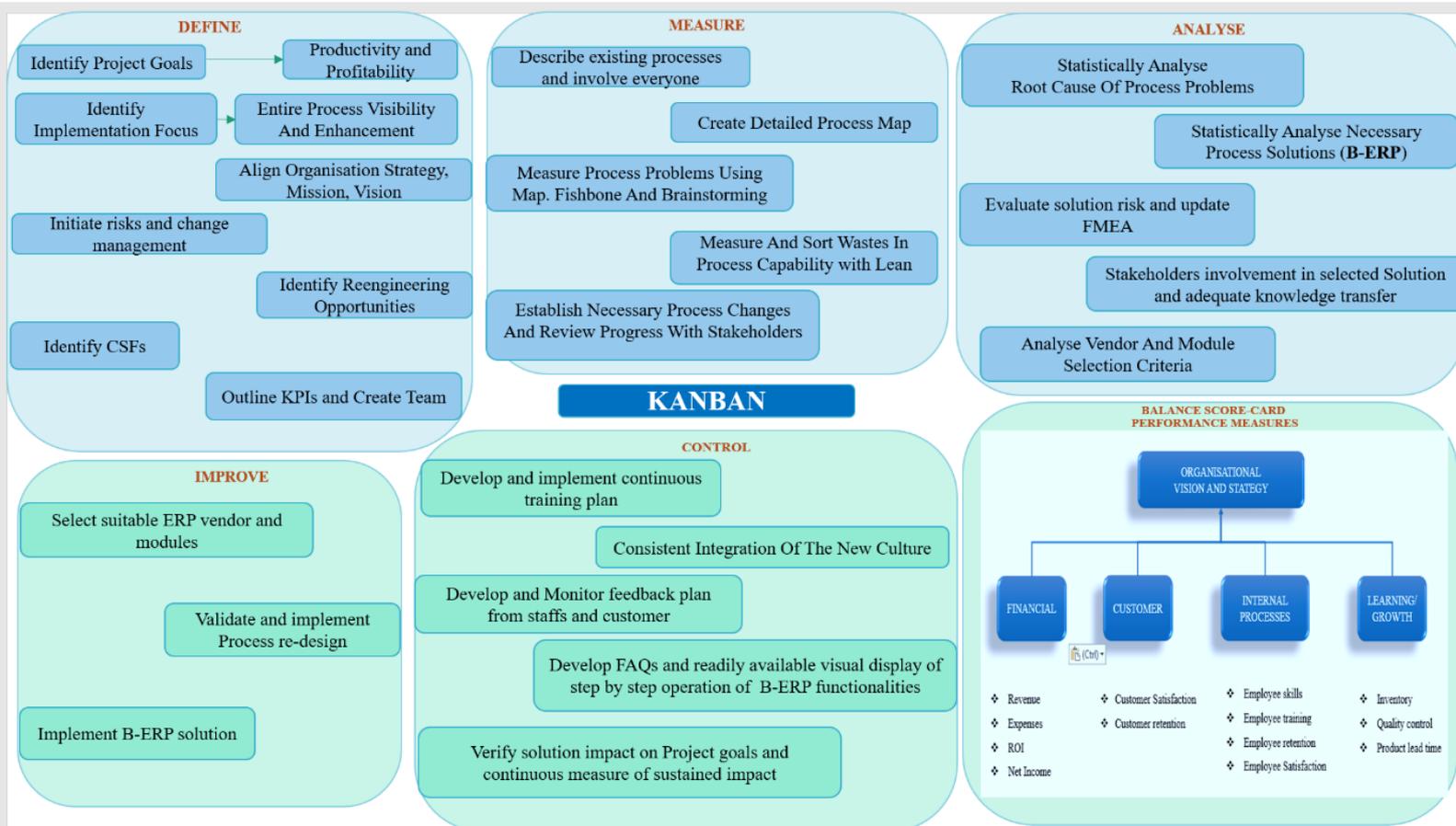
Enterprise resource planning software can be widely extended and customized to suit individual needs of an organisation. The vendor selection process for B-ERP implementation requires specific knowledge of ERP manufacturing modules and blockchain technology. This can be very useful in the extended ERP in the modern Industry 4.0 era. However, this concept needed to be carefully designed to maintain the required user-friendly interface. Its functions should be simple and easily integrated with the existing systems without the user noticing the underlying blockchain functionality. User friendly interface is very crucial to carrying out daily activities and general system acceptance.

As regards acceptability B-ERP model is designed to be simple to navigate, learn and easy to complete business operations. This is very essential for manufacturing organisations in Nigeria. Although, majority of the employees can be referred to be skilled but there are many with low level education and computer competence. The design consists of many components which is

carefully integrated to enhance the daily activities of a manufacturing organisation. Due to the environment, organisations prefer IT system relatively cheap, less technical, and economically viable. Therefore, ERP modules in this design are carefully selected and supported with blockchain technology. The features and functionalities of various components embedded in the B-ERP is described below.

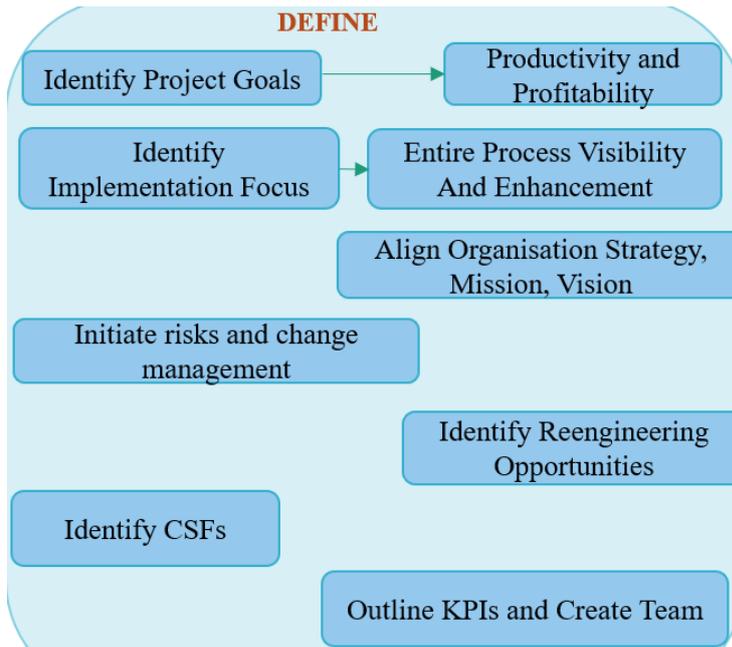
### **6.3.2 Kanban, Lean and six-sigma project tools before and during Implementation**

The implementation of ERP software requires maximum commitment to ensure success. Hence, this model design integrates necessary tools to ensure B-ERP implementation success and impact measurement. The Kanban tools is simply the complete visualization of progression stages which include backlogs, to-do, in-progress, testing and done. Lean is the identification and elimination of waste from various process. This can include waste from transport, inventory, motion, waiting, over-processing, over-production and defects. While the DMAIC is a core part of six sigma as a structured problem solving and process improvement model. This tool absorbs Lean and Kanban to create a successful B-ERP software implementation. The Fig 6.3 below depicts the integration process.



**Fig 6.3 B-ERP Implementation model.**

- ❖ **B-ERP Implementation Define Phase:** This is the first phase and appears to be very vital. Implementation projects requires defining the problem, identify of goals and project focus. The goals for a typical Nigeria manufacturing organisation are to enhance productivity, profitability and overall business performance. It is important in this stage to align the organisational strategy, mission and vision. Initiate risk and change management, identify re-engineering opportunities, identify the critical success factors (CSFs), outline the Key performance indicators (KPIs) and create the internal implementation team.



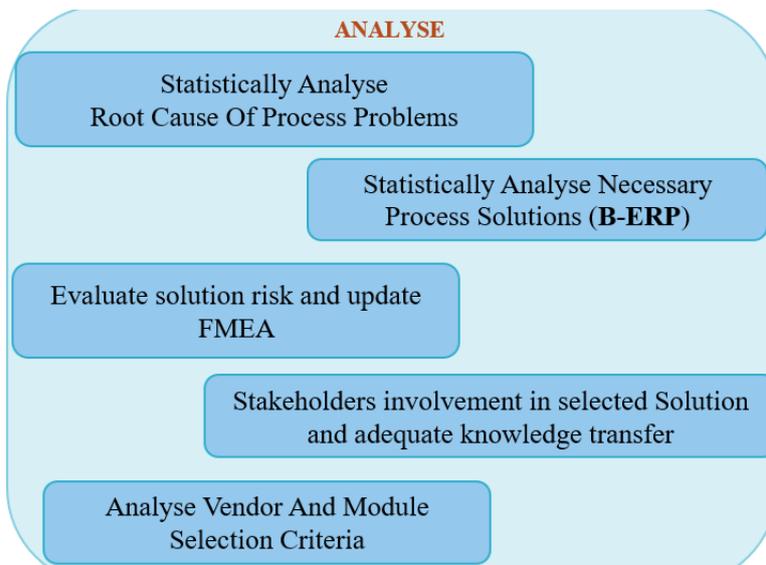
**Fig 6.3a B-ERP Implementation model.**

- ❖ **B-ERP Implementation Measure Phase:** The measure phase involves the description of the existing processes within the organisation as a baseline to compare any improvement made. This can be achieved by creating a detailed process map, measuring the problems in the process using the process map, fishbone diagram, and brainstorming. This is where Lean comes in to measure the waste in processes such as transport, inventory, motion, waiting, over-processing, over-production and defects. All these helps to visualise necessary process change based on stakeholders' reviews.



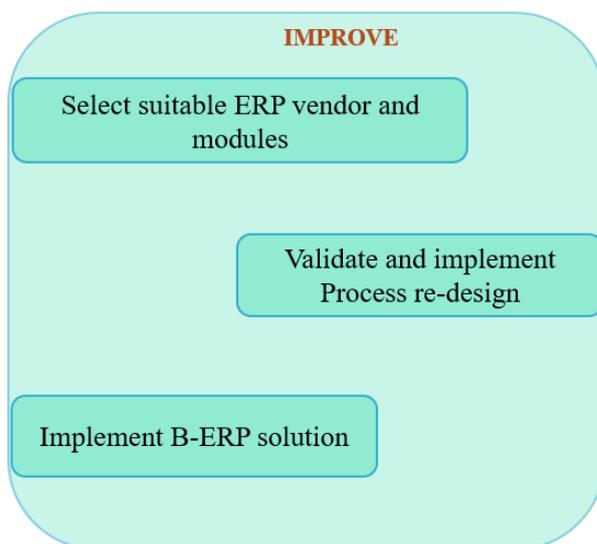
**Fig 6.3b. B-ERP Implementation model.**

- ❖ **B-ERP Implementation Analyse Phase:** The analyse phase aim to find the root cause of the problem under investigation. Information collected from the measure phase are used in statistical analysis of the problem and possible improvement solution based on feasibility and risk evaluations.



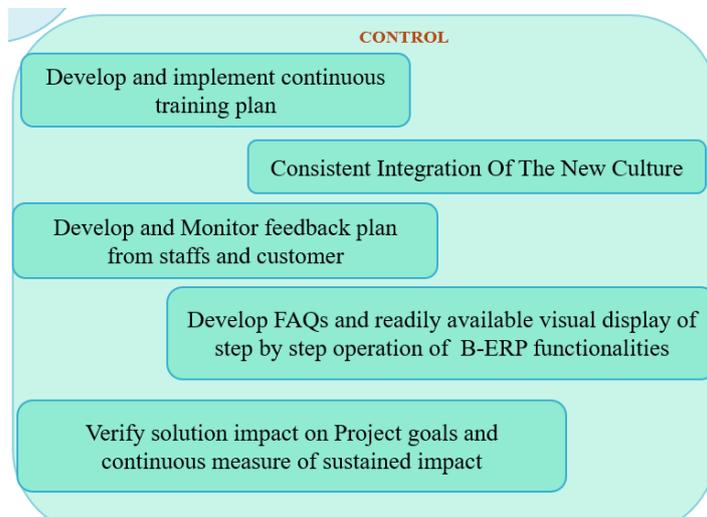
*Fig 6.3c. B-ERP Implementation model.*

- ❖ **B-ERP Implementation Improve Phase:** The aim of the improve phase is to implement a suitable solution, in this case the Blockchain ERP. This phase involves selection of suitable ERP vendor and modules. The validated necessary process changes are implemented, and the B-ERP solution is put in place.



*Fig 6.3d. B-ERP Implementation model.*

- ❖ **B-ERP Implementation Control Phase:** This aim to make sure that the improvements continue to meet the business performance over-time. There are various plans to put in-place in this phase such as continuous training plan, continuous feedbacks from B-ERP users and customers. Also, there is need for the vendors provide answers frequently asked questions (FAQs), prepare a visual display of step-by-step operation of B-ERP functionalities. On the side of the organisation there is need to verify the solution impact and continuous measure of sustained impact.



***Fig 6.3e. B-ERP Implementation model.***

### **6.3.3 Post-implementation performance measurement with balanced scorecard**

The balance scorecard takes a well-rounded approach to measure a business performance. The integration of blockchain technology is inclined towards the financial aspect of business performance. Hence, to achieve a long-term all-round business performance, including the financial and non-financial the balance scorecard model is used. The balanced scorecard helps a business to set their strategic goals, define action plans and develop Key performance indicators (KPIs) that will then monitor the delivery of their strategic goals. It aligns business activities to the vision of the business and monitors KPIs against organisational strategic goals.

The scorecard begins from the highest level of the business, that is the business strategy, mission, and vision. Afterwards, focused on key performance indicators, which is then viewed from four perspectives and considered from equal financial and non-financial perspectives.



**Fig 6.4 Balanced scorecard performance measurement**

The “financial” perspective relating to a business and some of the key performance indicators include revenue, expenses, ROI, and net income. These are the KPIs that are used to gauge financial performance in a business. The next on the balanced scorecard measure is very important “customer” perspective relating to a business and also some of the key performance indicators include customer satisfaction and customer retention. The next is the “learning and growth” this include employee skills, employee training, employee retention, and employee’s satisfaction. Apparently, if the skills are lacking, they will not be able to deliver on a consistent basis and also match up with competitors in the business.

Lastly are the “internal processes” the KPIs in the aspect include Inventory, quality control and product lead time. These are the KPIs that are used to gauge the internal processes of a business.

The listed perspectives can guide the Nigeria manufacturing organisations (NMOs) to map their action plans towards KPIs business success. Key performance indicators (KPIs) are often used in business as a measure of key performance against set standards. Therefore, the balanced scorecard provides complete view of business performance, which in-turn encourages long-term strategies and relevant information to all stakeholders.

However, there are shortfalls to balanced scorecard which include, the needs for a regular update, capturing all the perspectives effectively and simultaneously considering the vast amount of data required to measure KPIs. However, the findings indicated that employee participation is very low due to knowledge transfer, level of education and inability to ask questions. Therefore, this research suggested a portal on the B-ERP that presents operational summary video on FAQ question, feedbacks and answer with options of anonymity because even some of the top management don't know and they are unable or unwilling to ask subordinates.

#### **6.3.4 Kanban process visibility**

This is the concept of using a visual board with “work in progress limits” in order to manage workflow and improve process efficiency. Kanban uses a visual board either physical or digital board to display workflow and indicate progress. The process flow is in various stage columns, swim-lanes (rows), with the Kanban cards indicating what process is either done or in progress.

Table 6.1 below represents a sample of B-ERP implementation.

**Tab 6.1 Kanban process visibility**

BACKLOG	TODO	IN PROGRESS	TESTING	DONE
B-ERP implementation	Vendor Selection	Identifying CSFs		Identify project goals
	Module Selection	Brainstorming		Create teams
	New process validation	Existing process description		
	BRP	Process Map		

#### 6.4 Blockchain ERP (B-ERP) Modules and features

Enterprise Resource planning system supported with blockchain technology eliminates the issue of one point of failure (central database). This bring about trust in the environment, thereby presenting a transparent structure that encourages investors and business stakeholders. The management have a real-time insight towards making effective decisions. B-ERP is the same as a module-based conventional ERP system, there are no physically obvious changes. The module in each department automates business functions. This Allows effective process execution of each business applications and they are well organised and interoperable.

However, this is as result of the driving force behind the ERP system, which is to automate and simplify organisational operations, manage resources, and execute the strategic plan of the business. The modules in B-ERP were selected to suit and provide simple integration in accelerating operational synchronisation across entire functional units in a manufacturing organisation. The modules selected for the proposed B-ERP model, was carefully integrated to suit manufacturing organization's basic functional units, irrespective of the company and product they manufacture.

However, every product manufacturer wants uniqueness, competitive cost of production with a six-sigma defect-free status. All these are attributes of ERP's effectiveness, ERP system enables the manufacturer to access real time reports of their production facility, it maintains production schedule with good quality standards in compliance with regulations. Also supply-chain efficient, making sure that the required components arrive on time accordingly. B-ERP is also designed to effectively coordinate facilities, and equipment. Inventories are properly managed from raw material to work-in-process and finished product. The system maximizes production operations by minimizing bottlenecks and downtime in production.

The technology encourages effective process coordination. Therefore, user can focus on manufacturing the products better and faster. Manufacturing organizations in Nigeria wants to implement ERP module that suits their business requirements and environment. Some of the major modules that can be included in B-ERP are production planning, manufacturing & production, supply-chain, quality control, inventory management, account & finance, sales & marketing module, customer requirement management (CRM), human resource management (HRM) and so on.

There are many other components that represent the micro view of the B-ERP modules. They are available across the entire business departments to manage business resources. The components allow automatic flow of data through the major modules. Broad view of functionalities integrated into the major modules are represented below:

- ❖ Materials requirement planning (MRP)
- ❖ Blockchain tracking and traceability
- ❖ Customer relationship management
- ❖ Bill of materials
- ❖ Warehousing and Inventory stock control

- ❖ Visualization report various business analysis
- ❖ Advance planning system
- ❖ Detailed costing (Actual, expected, and Standard)

**Tab 6.2 Integrated modules in B-ERP**

Warehouse management	Real time machine monitoring	Real time process monitoring	Ecommerce	Preventive maintenance	SPC & collection
Product lifecycle management	Customer relationship management	Estimating & quoting	Sales order management	Capacity planning	Quality process management
Tooling & project management	Supply chain management	Finance & accounting	Accounting receivable & payable	Planning & scheduling	Document control
Customer & supplier portals	Job & process costing	Shipping & distribution	Quality management	Inventory control	Forecasting
Employee self-service portal	labelling	Automated workflow		Production control	Expense tracking
	MS Office interfaces	Automated workflow	Internal Quality Assurance monitoring	Business intelligence	
Fixed assets	Payroll	Workforce	Time & attendance	Outsource central	Multi-plant multi-company (ICT)

#### 6.4.1 Inventory control module

The inventory control module in B-ERP design maintains safe stock levels activities from the raw materials to the warehouse. This module also identifies and manage inventory status and requirement with a pre-set target. This allows informed decision making and automated replenishment option. It is an effective way of monitoring and controlling manufacturing

material usage and finished products. Also, there is a proper maintenance of inventory status report, allowing any concerns raised on safety stock level promptly for balance reconciliation.

The B-ERP Inventory module can be used to track the stock of items. An item's unique details are stored on the blockchain, tracked, and traced using their unique digital signature. Inventory can maintain an item's current location in organization more effectively. This module functionalities entails inventory control, stock utilization reporting and so on. In B-ERP, inventory module is well integrated with other modules such as finance, purchase, sales modules. The integration allows responsive reports to support decision making function at the management level.

#### **6.4.2 Sales and Marketing**

Conventional sales process involves drafting sales quotations, receiving sales orders, processing sales invoices, dispatch, tracking pending sales order and so all. All these sales components are managed effectively by sales module. B-ERP's sales module manages and schedule orders invoicing. Also, the Sales module is sensitively integrated with other module's activities. B-ERP sales module also retain the marketing activities such as automated e-mailing and many more marketing activities.

#### **6.4.3 Human resources module**

Human Resource module simplify handles the HR activities. This module holds employee's personal details, salary information, attendance record, promotion updates, all staffs training and performance evaluation. B-ERP can be used to hold and check authenticity of past record provided by potential employee, including their certificate. This module supports HR team in effective management of human resources. An employee records is performance statistics is easily traceable including job descriptions, skill pattern, hours worked and attendance rate. The payroll system is quite important part of Human Resource module, it manages employee's

salaries and complies it as part of the production cost report. This can also track and include other expenses such as travel and reimbursement.

#### **6.4.4 Finance module**

The finance module is about the most crucial and critical module in an entire organisation. This module records inflow and outflow of revenues and expenditures. The finance module manages all finance account related operations such as expenses, financial ledger, account balances, budget, bank financial statements, purchase invoices and payment receipts and tax record. Finance record is made easy with the B-ERP module because blockchain is super-efficient with financial transactions. Therefore, finance module is taken seriously and its one of the main elements in the B-ERP providing automated audit and immutable financial activities.

It is well integrated with other modules, designed to collate financial data from other functional units in an organisation and generate financial reports. Reports provided reveals detail financial view that maybe monthly, quarterly, and yearly financial accounts statements and they are easy interpreted to support decision making process.

#### **6.4.5 Supply chain management (SCM) module**

Supply chain module handles the entire activities that involves flow of items ranging from raw materials to finished product. SCM is activated from the supplier, manufacturer to the end-user (consumer). Parties typically involved in this supply chain are the manufacturer, retailers, distributors, wholesalers and so on. SCM manages the supply of product, returns and replacement processes. The shipping and transportation tracking is effectively managed using blockchain. Some research studies look into blockchain for supply chain and it is proven to be very effective. Also, in 2018 IBM and Maersk announced partnership towards a streamline supply chain utilizing an extraordinary digitally secure trading platform delivered by IBM Blockchain.

The system caters for transparency, simplicity and openly uniform standards when product is transported across borders and zones (Ganne, 2018). The system also eliminates some challenges by simple process automation. B-ERP can efficiently simplify the SCM operations of organization. Other modules are effectively integrated in B-ERP framework. Blockchain integration with Enterprise Resource Planning system gives you detailed understanding of every product in the business supply chain. This supply chain becomes trustworthy, secure, and transparent from the raw material to finished product distribution and up to the return/replacement. In-depth knowledge of products location within the supply chain is crucial for maximizing efficiency.

The rapidly growing demand about transparency by the end-users and regulators on how and where products are made requires the blockchain intervention. Trust and transparency have been a major issue in the supply chain industry. However, further than just information, supply chain can be complex, and its efficiency will have to depend on trust between organisations. But distrust between businesses hinders them from relying on data shared. B-ERP will resolve this with digital real-time and shared permission of ownership with product location. The efficiency in shared record transparency can increase trust within businesses. The table below display challenges encountered in the SCM and the blockchain transformation in the Supply chain activities developed by IBM.

***Tab 6.3: Current challenges in supply chain management by IBM (Blockchain, 2018)***

Real-time Resolution		
Challenges	Opportunities	Proposed Solution

<p>Sophisticated supply chain can also be in chaos in an extraordinary situation such as natural disasters, unforeseen circumstances like shortages or spikes in demand or a series of minor issues. Any faulty SCM such as delayed delivery, can impact production in today's market</p>	<p>Some delays are inevitable such caused by weather condition, labour conflicts, and human error. These real-world issues can be resolved via blockchain-optimization. The shipment knowledge of supply chain at risk can automatically trigger a smart contract condition of alternative solutions such as price adjustments or supplier substitutions.</p>	<p>IBM is building an AI network technology that will forecasts the unforeseen instead of waiting to react. Furthermore, to ensure quality of food products, blockchain reliable data could soon feed an AI solution. This will enable many things such as tracking inventory and predicting future demand and supply and foreseeing possible future repairs or replacements.</p>
<b>Tracking, transparency, and trust</b>		
<b>Challenges</b>	<b>Opportunities</b>	<b>Proposed Solution</b>
<p>The Supply chain knowledge should be more than product location at any given time. But to detect the source of defective parts or failed component. The ability to trace the provenance of previously distributed goods have always been a challenge.</p>	<p>The use of blockchain data storage, that indicate geographic flow of product and how it was handed. This allow you to analyse sources, investigate certifications, track restricted or components discover storage-condition abnormalities and more.</p>	<p>This Blockchain solution by IBM has been adopted in the aviation industry by an aircraft manufacturer to trace the detailed provenance, status, and location of their components. This brings about quality from inception and trustworthiness at various capacities. There is an evidence chainage of documentation on certification, installation, and quality inspection.</p>
<b>Visibility and data consolidation</b>		
<b>Challenges</b>	<b>Opportunities</b>	<b>Proposed Solution</b>

<p>Complex and contrasting record-keeping systems can result in unreliable manifests, bills of (BOL) lading, certifications and much more.</p>	<p>The efficacy of blockchain data storage allows all relevant information to be viewed simultaneously in real-time. The information will be securely available to stakeholders such as sender, receiver, delivery services and regulators.</p>	<p>This Blockchain solution by IBM and Maersk partnership promised to streamline shipping with secure and efficient global trade digitization based on Blockchain. The mission will tackle needs for transparency, simplicity and quality standards as goods are transported across borders and trade zones</p>
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Some of the efficacy of Blockchain applications is to address a wide range of supply chain challenges such as listed below (Blockchain, 2018);

- ❖ How to ensure that supply chain information is consistent and dependably maintained.
- ❖ To find out if a standards-based APIs can be employed to simplify data transfer.
- ❖ Provide tools that can substantially reduce fraud and mistakes.
- ❖ To boost or increase consumer and partner trust?

#### 6.4.6 Customer Relationship Management (CRM)

The effectiveness of customer services cannot be understated. Customer relationship management module enhance sales performance. This department is equipped with tools to provide an efficient customer service. Establishment strong relationship between an organisation and their customers is very important. Every relevant customer detail is stored securely in the CRM module. The pool of customer information available to the CRM module allows it to manage and track detailed customer relationship history, calls, meetings, details of purchases frequency, active contracts and so on. Customer Relationship Module is integrated

with other modules in the organisation, but it is more beneficial to sales module as it enhances sales opportunities.

#### **6.4.7 Purchasing module**

This module can also be referred to as the procurement module. Procurement department make use of the purchase module and their activities can range from the purchase of raw materials required for manufacturing products in the organization and so on. This module provides access to the list of suppliers, linking supplier to their item, sending, and managing quotation request, receiving and recording quotations, quotation analysis, purchase orders, purchase product tracking, making goods and receipt notes and other relevant reports.

The Purchase module is integrated with other modules in an organisation. It is mostly beneficial to the inventory module and production module for an automated stock update. Purchase module in B-ERP has an in-depth capacity in tracking raw materials origin to meet the exact specification of production. It automates the relevant processes to identify suppliers, price opportunity, create purchase orders and billing activities. Purchase module frequently accessed by the production planning, inventory control and supply chain.

#### **6.4.8 Production planning module (PPM)**

Enterprise Resource Planning (ERP) software continues to extend in capacity to accommodate large and rigorous production processes. ERP vendors seek to introduce further extended ERP options. Manufacturers identified that; they will need to be a step ahead of production huddles. Different types of robust technologies for production planning are introduced including data science and artificial intelligence. All these unique technologies are also considered in B-ERP. Production planning module in B-ERP includes various functionalities to enhance production capacity. Components such as material purchase and sales forecasting are generated by

Artificial intelligence (A.I) feed with big data. Some of the functionalities integrated into Production planning module in B-ERP are indicated in Table below.

### **6.5 Influence of CSFs on ERP implementation within the NMOs**

Enterprise Resource Planning (ERP) adoption determinants are based on the empirical research conducted from survey and interviews. This study collated a list of determinants considered in a theoretical suggestions of ERP adoption and implementation. The key reason for analysing and prioritising these determinants is to increase the implementation success rate. In the target organisations numerous benefits of ERP is expected if properly implemented. There set of data collected from manufacturing organisation's management. The data reveals that, in practice manufacturing organisations in Nigeria does not scale determinants in categories, factors, and phases while adopting and implementing various Information technologies.

The ERP adoption determinants identified from data collected for this study was prioritized and ranked. They were identified from the feedback provided by the study participants. Some previously identified factors such as, system customisation constraints and resistance to change are said to be very significant. This study assessed the ERP system based on the analysis of specific needs, which could possibly lead to production enhancement. Design was also based on their existing stage of the technology infrastructural capacity and manpower. Many organisations have dedicated project champion, which is one of their key workers fully engaged in ERP adoption.

All these can be achieved with the top management commitment from top to bottom and efficiency in vendors selection. Also, the help of qualified system advisors and ultimately the readiness and understanding on the part of the end users and the entire project team (employees). However, the action of all stakeholder such as top management, project team, other staffs or end-users, vendors, and advisors will allow fast organisational learning to take

place by knowledge transfer, otherwise known as human capital development. Knowledge transfers contribute to create human capital development, but it will also infuse the organisation with continuous learning culture. Therefore, Knowledge Transfer is classified under stakeholder's commitment as a critical success factor throughout the lifecycle of the system adoption.

The testing stage is very important, because this stage takes care of unforeseen events that may occur through and after Go-Live stage. The risk management strategy during Post-implementation can be sub-categories into four (4) namely: avoidance, mitigation, transference, and limitation. This management strategy allows the case study manufacturing organisation to prepared against any risk. Risk and its management are a broad phase but according to the case study organisation's perspective, potential risks can be curtailed based on the structure, culture, technology, process change and stakeholders' responses. Therefore, risk management strategy is a cogent determinant considered according to the organisational perspective of new technology adoption.

**Tab. 6.4 Factors influencing ERP adoption and CSFs within the NMOs**

Change process Dimension	Influencing factors	Critical Success Factors (CSFs)
<b>Organisation</b>	Adoption Funding/Cost	Knowledge transfer
	'Enhance production and profitability'	Change management
	Staff skills and training'	Top management support
	Top Management Commitment	User satisfaction
	'Information Awareness'	Communication Effectiveness
	IT Staff competence	User training and development
	Training and Development	Vendor/customer partnership
	Structure Culture	Clear goals and objectives

	Change Management	Interdepartmental communication
	End-User commitment External Advisory Support	Minimal customisation
	Project Management	
	Execution Team	
	Schedule	
<b>Technology</b>	'Trust and Reliability'	IT infrastructure
	System Effectiveness	Use of information management tools
	'User friendly/Less complex'	
	Package Selection	
	'IT Infrastructure'	
	Information/Data Quality (Trust)	
<b>Process</b>	Business Process Reengineering	Data analysis and conversion process
	Customisation Approach	Business process re-engineering(BPR)
	Performance Measurement and Control (DMAIC)	

### 6.5.1 Knowledge Transfer

The responsibility of designing, planning, managing, and delivering connected knowledge transfer by training or educating the stakeholders involved on how to utilise the relevant ERP programs, respectively. Most especially the in-house IT team involved in the entire ERP adoption and implementation processes. Next is the effective knowledge transfer and system awareness plans. Which can be done to develop or enhance the experience of the end-users. This improves the organisation's internal technical expertise, knowhow, skills and builds a focal point of ERP competent environment.

All these was the responsibility of this research program in collaboration with the Vendor and was achieved to improve or develop the technical expertise and skills of the end-users by enabling them to efficiently and effectively acquire the vital competencies to operate and

maintain the re-designed ERP solution. Hence, offering a world class collaborative standard by transferring knowledge. The next stage of support includes, providing support to manufacturing organisations business partners, towards the effect of daily use of the ERP system in their partnership. The implementation testing creates a dedicated support centre that is ready to assist partners concerning any issues encountered related to the use of ERP system.

The support centre will investigate reported problem and identifies a suitable solution towards it. Some of the activities to be carried out during the implementation test phase include:

- a) Handling and maintaining quality of all the essential paperwork to ensure quality data feed into the system.
- b) Testing the features and functions of the system. This include the proposed changes from feedbacks and modifications required in the test. Registering all necessary data needed for the system testing. Ensuring the end-users support and commitment in the testing phase.
- c) The end-user's commitment is also needed to provide all the required information to the system before and after the system Go Live.
- d) The overall system re-design and set-up is done by the research study and the vendor. The set-up is carried-out throughout the implementation stages. considering agreeable approval by the end-users.
- e) Basic service sets (BSS) were used for system customisations and patches, which are wirelessly networked. The connected devices within the BSS is recognized "Basic service set identifier" (BSSID). All these is done after a comprehensive inspection is carried-out and documented. The research project presents clear documentation for the entire process, which was made available to the trained BSS expert in the case study organisation. The internal IT staffs were trained to facilitate and sustain overall system functionalities once the project is over.

### **6.5.2 Change management**

The system improvement may include seamless update of the re-design ERP system towards data traceability and information efficiency within an organisation. In this situation, Enterprise resource planning system displays no obvious change but as part of business enhancement, the invisible change should be communicated to staffs and managed. It requires proper change management in order to achieve its intended purpose. Managing change and its related conflicts is a priority of top management. The present characteristics and processes of an organisation before change may be incompatible with proposed change through ERP system. In other words, it will be beneficial to adopt a continuous change management approach especially during system updates.

### **6.5.3 Top management support**

Top management support spans throughout the lifecycle of the organisation, meaning the extent to which the management of an organisation offers direction and resources during and ERP systems updates. Management support is a driver for staff's performance towards achieving the organisation's strategic goals. On the other hand, lack of support from top managers in an ERP implementation can be catastrophic. Several studies on ERP systems, has identified top management support as a critical success factor for ERP projects. Therefore, top management support can decide on ERP adoption, modules and type of updates performed. The support can be instrumental for the overall success of the re-designed ERP systems even at the post-implementation stage. The implementation success is great, when there is a unified backing and dedication from top members of the various functional units is involved.

### **6.5.4 User satisfaction**

According to the research findings, User satisfaction is very important to ERP implementation success. ERP system interface, training, knowledge transfer and so on contributes immensely

to end-user satisfaction. Although, blockchain integration into ERP system is a seamless operation, nevertheless the user needs to be confident using the ERP system generally. Otherwise, there will be no motivation if the system is not easy to access for completing daily tasks. Considering this stance, B-ERP model is designed with ease of use to carry out daily activities and it is easy to learn. This attribute is very important in the manufacturing environment, the applications should be navigated with ease, the ease of use is given more focus in the design of the proposed blockchain ERP model.

### **6.6 B-ERP business process re-design and Risk Management**

Business process re-design (BPR) is the beginning of transformation in an organisation. Therefore, it is reflected in the proposed B-ERP. BPR is a radical redesign of the existing work process to better support the organization by reducing costs and competitive advantage in long run. The concept of re-design should be directly connected with a macro review of an organization's mission, strategic goals, and customer requirements. The basic framework of an organisation contains its mission and goals. However, an organization might realise that it has been operating below its maximum capacity, particularly in terms of their strategic goals and meeting customer needs.

This is where re-design sets in and it focuses on radical changes created in the organization's business processes. Process include the daily activities, steps and procedures employed to create products or/and services that meet the market demands. Also, risk management during implementation is very important due to uncertainties, which sometimes can cause the project to deviate from the initially set plans. Thus, managing ERP implementation project risk is crucial in order to reduce the impact of accidental events during the project. This can be accomplished by identifying the main possible risks even before any negative effect on the project. The management benefit from the wealth of vendor's knowledge and expertise in

managing risks successfully especially when implementing information technology projects such as Enterprise Resource Planning.

The participants during the research interview acknowledged the knowledge gained from the vendors towards risk management as very productive and beneficial in the exploration of the potential risks. Also, progressive risk management process should be maintained in accordance with a thorough planning process with continuous assessment to provide update accordingly when required. Also, it was indicated that potential risks should always be discussed with maximum involvement of key stakeholders in various meetings where risks are categorised in various levels. The levels are identified as high, medium, or low-level risk, based on rigorous assessment of the possibility of such risk happening.

A response plan is then developed especially for every high-level risk, to either limit, share or eradicate them making sure that every risk is treated accordingly. There are five major responses to specific risk namely, acceptance, avoidance, transference, mitigation, or exploitation. The project management team are required to assess the provide risk plans multiple times during the project. The outcomes of risk management later indicated the significance of managing the risk from start to finish.

## **CHAPTER 7**

### **VALIDATION OF PROPOSED MODEL**

#### **7.1 Introduction**

In this chapter a scientific approach is used to validate the proposed B-ERP model. The approach involves the selection of eight (8) manufacturing organisations to examine the proposed model. The companies selected already have IT infrastructure in place to test the

proposed model. Five (5) of these organisations already have Enterprise Resource Planning (ERP) software with limited functionalities with other non-integrated systems in place while the rest three (3) have well integrated ERP system in place across the organisation, all deployed on cloud by the same vendor. This research was established on the viewpoints of staffs in the manufacturing organisations.

All of the employees involved in this research are professionals in their manufacturing organisations respectively. They include production engineers, project managers, line managers, quality control, manufacturing floor supervisors and I.T experts. A statistical study is used for the validation to explain the improvement in the manufacturing processes. The benefits of B-ERP in manufacturing organisations is also analysed in this section. The end-user's view, that is the professionals in manufacturing organisations, such as managers at various capacities in a manufacturing organization. In addition, the strengths, weaknesses, advantages, and disadvantages of the B-ERP was identified via the empirical analysis from a descriptive study.

### **7.1.1 Validation variables of the study**

The validation study is an investigative study that verify the adequacy of the research. At this stage, the research used a small-scale study in representation of the entire population. This study takes the form of a pilot study conducted to know the potency of B-ERP in the Nigeria manufacturing industry. The views of IT professional, manufacturing managers and top management was very instrumental to the researcher's validation. The statistical categories used in the validation research were descriptive and association within variables. The variables were analysed, and Organisational Performance were identified. Demographical variables include the participant's job description. The analysis intent is to characterize some of the B-ERP critical success factors, which include top management support, employee motivation &

participation, business process re-engineering (BPR), business management and system reliability. Some of the variables presents B-ERP benefits, provide user's job satisfaction and overall business performance.

### **7.1.2 Primary objective of the validation study**

- ❖ To characterize the critical success factors of Blockchain ERP.
- ❖ To justify the significance of B-ERP on Organisational Performance within NMOs through statistical analysis.

### **7.1.3 Limitation of the validation study**

- ❖ Due to the Covid-19 pandemic constraint samples was limited
- ❖ The validation was based on the facts and view given by the limited data set only.

### **7.1.4 Questionnaire and participants**

The questionnaire was designed to measure the benefits of B-ERP benefits and its degree of impact within the Nigeria manufacturing organisation. A five-point Likert type scale was used to quantify agreement with each statement. Manufacturing organisation personnel in Nigeria partook in the validation survey. This was achieved with the research collaboration of an ERP service provider (Vendor). They provide cloud service which was upgraded with an immutable ledge functionality. The update was optional for their clients, as the integration was seamless and no disruption to the service provided. The participant includes solely manufacturing organisations with ERP systems in place, were selected for the validation. The main participants were the Management and Senior IT personnel's who are responsible for decision making as IT adoption and product manufacturing.

### 7.1.5 Sampling and variables analysis method

Convenience sampling technique is used in the analysis. In this technique, a non-probability sampling technique, i.e. Sample is collected from organisations or people that are easy to contact or to reach. Therefore, there is quick access to selected participants. A structured questionnaire is used to collect quality response from the participants, as primary data was collected in this study. Investigative aspect of the validation was based on the primary data collected. The data was analysed with the descriptive analysis. Every variable was analysed in simple percentile initially. The percentage measures are tool used to identify study characteristics in the data collected. The study of both satisfactory and dissatisfactory variables was established on the degree of proposed system impact.

The five-point Likert's scale was used, representing opinions from strongly disagree, disagree, neutral, agree and strongly agree. Statistical Package for the Social Sciences (SPSS) software was utilized to analyse the data collected. Primary data was collated from Nigeria's manufacturing organisations via questionnaire and the data was collect for research validation. The questionnaire was divided into two section, which include the participant demographic details and anticipated impact factors of B-ERP.

### 7.1.6 Data Reliability

Reliability analysis was carried out to measure internal consistency between scale variables in the data collection tool of B-ERP validation study. Cronbach's Alpha validity measure is mostly used when there are multiple Likert's scale questions in a survey. Hence it is used to determine the reliability of the questions in a questionnaire. The values obtained are represented in the Table 7.1a and 7.1b below

*Tab 7.1a Cronbach's Alpha*  
*Case Processing Summary*

		N	%
Cases	Valid	100	64.5
	Excluded <sup>a</sup>	55	35.5
	Total	155	100.0

a. Listwise deletion based on all variables in the procedure.

<i>Reliability Statistics</i>			
Variable Construct	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
CSFs	.848	.850	16
Organisational Performance	.759	.760	6
ERP User's Satisfaction	.778	.780	6

The information from the table above shows that the Cronbach's Alpha is 0.848 which indicates a relatively adequate level of internal consistency in the chosen scale and sample. According to Pallant (2013) anything from  $\geq 0.70$  is okay.

## 7.2 Demographical analysis

The demographic description in Table 7.1 indicates the level of participants authority in their organisations, respectively. 73% of the participants are board members in the Top management, 16% are IT managers while 11% are the production managers. The feedback from these categories of staffs will be very benefit in measuring the through impact of B-ERP on business performance.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Board/ Top Management	73	73.0	73.0	73.0
	IT managers	16	16.0	16.0	89.0
	Production managers	11	11.0	11.0	100.0

	Total	100	100.0	100.0	
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The demographic description in 7.2 indicates the production category of the participants in the validation study. Agricultural products still remain huge of about 32%, followed by domestics of 28% next is the print and ink and so on.

**Tab 7.3 What is your company's product category?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agricultural	32	32.0	32.0	32.0
	Automobiles	5	5.0	5.0	37.0
	Construction	5	5.0	5.0	42.0
	Domestics	28	28.0	28.0	70.0
	Electrical and Electronics	3	3.0	3.0	73.0
	Food, Drinks and Tobacco	10	10.0	10.0	83.0
	Print and Ink	13	13.0	13.0	96.0
	Steel and Metal	4	4.0	4.0	100.0
	Total	100	100.0	100.0	

### 7.3 Statistical Representation of B-ERP impact on NMOs

The tables below represent various statistics data collected from the blockchain ERP (B-ERP) integration framework. The validation questionnaire with Likert scale score ranging between from 1.00 -5.00. That is 1.00 represents “most agreed” 3.00 is neutral and 5 represents “most disagree”. The standard deviation represents the amount of deviation from the mean. The statistics does not only measure B-ERP influence on financial aspect of manufacturing organisations but the entire business re-design such as financial, customer, internal processes, and learning/growth.

The mean indicates how much influence B-ERP framework has on each variable. The data shows that with more room for employees to ask questions and provide feedbacks “employee

participation” improved drastically with 1.09 mean value. Next is the “stakeholders’ insight” with mean value of 1.22, this is most likely to encourage investors as a result of transparency. Also, the employee participation led to an effective use of the B-ERP system, thereby with a mean value of 1.45. The “company strategy” has a mean value of 1.72. Next is the “training and education” with 2.17 mean value, this is very helpful to boost employee’s confidence in their daily operations. This is followed by “Knowledge transfer” 2.20 “Top management” 2.21 and “Business process reengineering” mean value of 2.31.

**Tab 7.4: Descriptive Statistics for B-ERP adoption influence**

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
"Company Strategy"	100	1.72	1.092	1.529	.241	1.416	.478
"Top Management"	100	2.21	1.559	.948	.241	-.679	.478
"Stakeholders insight"	100	1.22	.773	4.014	.241	16.270	.478
"Knowledge transfer"	100	2.20	1.271	.939	.241	.061	.478
"Business process reengineering"	100	2.31	1.134	.378	.241	-.317	.478
"Employee participation"	100	1.09	.404	4.451	.241	18.547	.478
"Reliability, effectiveness and efficiency"	100	1.45	.783	1.841	.241	3.534	.478
"Training and Education"	100	2.17	1.280	1.091	.241	.309	.478
"User friendliness"	100	2.31	1.293	.660	.241	-.404	.478
"Production and profitability"	100	1.95	1.067	.712	.241	-.246	.478
Valid N (listwise)	100						

### 7.3.1 Hypothesis statement

The hypothesis statement in this chapter is based on the prior findings of this research. The finding suggests the need for a trust-based system to mitigate corruption practice. Therefore, blockchain technology is proposed and the hypothesis statement goes thus; **“if Blockchain is**

**integrated into ERP system, it will improve organisational performance in Nigeria manufacturing organisations”.**

### **7.3.2 Econometric models and variable measurement for B-ERP**

Econometric models are created with the aid of statistical inference techniques. These models are usually based on the combination of statistics and economic theories. Studies show that in developing econometric model researchers make use of regression analysis. The regression analysis studies the relationship between the dependent and independent variable(s). This section of the research investigates how the adoption of B-ERP contributes to overall Organisational performance with the NMOs.

How the variables was measured. The questionnaire survey was designed to measure the impact of B-ERP by measuring the employees perception of impact and success various functional units. However, the critical success factors (CSFs) identified in previous chapters are held constant as control variables. Then, the overall organisational performance was measured using the statistical relationship analysis to judge how blockchain integration with ERP relate to or influence the overral organisational performance.

$y = \beta_0 + \beta_1 X_1 + \varepsilon \dots$  Investigating the contribution of B-ERP on overall organisational performance

*Regression equation* whereby;

y = Dependent variable (Organisational performance)

$\beta_0$  = the intersect of the y axis

$\beta_1 X_1$  = B-ERP adoption impact

$\varepsilon$  = error term

Where by;

y = Organisational performance.

$X_1$  = Is measured via B-ERP user's Perception of impact.

### 7.3.3 Perceived impact of B-ERP within the functional units of NMOs

The perceived impact of blockchain integration into ERP in the functional units within the Nigeria are displayed in the tables below. The 'Accounting' and 'Inventory/Stock management' appears to be the most impacted by B-ERP with 94%. followed by the 'Supply-chain management' of 79%. The 'Human resources' department is fairly impacted with the blockchain integration while 'Sales and Marketing' department and the 'Customer resource management' department appeared to less impacted with the B-ERP framework.

**Tab 7.5: Impact Frequencies**

		Responses		Percent of Cases
		N	Percent	
Organisational Performance on functional units <sup>a</sup>	'Accounting and finance'	94	24.9%	97.9%
	'Human resources and pay roll'	37	9.8%	38.5%
	'Sales and Marketing'	37	9.8%	38.5%
	'Inventory/Stock management'	94	24.9%	97.9%
	'Customer resource management'	37	9.8%	38.5%
	'Supply-chain management'	79	20.9%	82.3%
Total		378	100.0%	393.8%

a. Dichotomy group tabulated at value 1.

**Tab 7.6: Impact\*ERP success Impact Crosstabulation**

		How successful can you classify the re-design ERP system?					Total
		Satisfactory	Above Average	Average	Below Average	Non-Satisfactory	
Acc & finance	Count	62	9	15	1	7	94

Organisational Performance on functional units <sup>a</sup>	HRM and payroll'	Count	24	3	6	0	4	37
	S & M	Count	24	3	6	0	4	37
	Inventory/Stock management'	Count	62	9	15	1	7	94
	CRM	Count	24	3	6	0	4	37
	'Supply-chain management'	Count	52	6	14	1	6	79
<b>Total</b>		<b>Count</b>	<b>64</b>	<b>9</b>	<b>15</b>	<b>1</b>	<b>7</b>	<b>96</b>

Percentages and totals are based on respondents.

a. Dichotomy group tabulated at value 1.

<b>Tab 7.7 Correlations</b>		B-ERP_Impact	B-ERP_user_sat
ERP_Impact	Pearson Correlation	1	.032
	Sig. (2-tailed)		.748
ERP_user_sat	Pearson Correlation	.032	1
	Sig. (2-tailed)	.748	
Impact_Acc	Pearson Correlation	.823	.654
	Sig. (2-tailed)	.000	.000
Impact_HRM	Pearson Correlation	.845	.912
	Sig. (2-tailed)	.000	.000
Impact_SM	Pearson Correlation	.345	.740
	Sig. (2-tailed)	.042	.002
Impact_Invent	Pearson Correlation	.890	.872
	Sig. (2-tailed)	.000	.000
Impact_CRM	Pearson Correlation	.429	.911
	Sig. (2-tailed)	.000	.000
Impact_Supply	Pearson Correlation	.680	.814
	Sig. (2-tailed)	.003	.000

## 7.4 Findings discussion

The findings from the data analysed shows that a successful ERP implementation had a substantial effect on overall organizational performance. The implementation of B-ERP within the Nigerian manufacturing organisations (NMOs) which tested the proposed model achieved improvement. The benefits of B-ERP according to findings, are the positive impacts on

functional units within the organisations. The increased finance income and expenditures reduction, inventory enhancement, outstanding supply chain management. and consistently short delivery schedules. The B-ERP successful impact on organisational performance as a dependent was variably influenced by various independent variables indicated in the regression analysis.

In other words, B-ERP implementation critical success factors CSFs are the predictors of a B-ERP successful outcome. In every instance of the independent variables “sigma” or P value ranging from “.000 - .042” are entirely significant. Also, the intercept slope value “B” which indicates that for every step increase in each predictor, B-ERP success increases with the intercept slope “B” value associated with it. These are the value representations: Company Strategy (B = .505, p = .000), Top management support (B = .419, p = .000), Stakeholders insight .536, p= .000), Knowledge transfer (B = .412, p= .000) Business Process re-engineering “BPR” ((B =.621, p =.042), Employee participation (B =.735, p = .000), Reliability, effectiveness, and efficiency (B =.641, p= .000) Training and Education (B =.450, p = .029) User friendly/Less complex (B =.509, p = .000) Production and profitability (B =.424, p = .000).

Next is the Pearson Correlation among variables such as “ERP\_Impact and B-ERP user satisfaction”, with the organisational functional units. This is to examine the correlation and statistical significance of “Organisational Performance and user satisfaction” on the functional units. The correlation matrix table is symmetrical on the diagonal and correlation table was modified on SPSS to show basically what is needed. Therefore, from the findings we saw that “B-Organisational Performance” and “user satisfaction” are statistically significant in every functional unit of the organisation with  $P < 0.05$  and there were positive linear associations.

Also, there was a linear association of 0.748 between “B-Organisational Performance” and “user satisfaction” which was also statistically significant.

## CHAPTER 8

### CONCLUSION, RECOMMENDATIONS, LIMITATIONS AND FURTHER STUDY

#### 8.1 Conclusion

The purpose of this research was to investigate the impact of ERP system within the Nigeria manufacturing organisations and to develop an implementation framework (B-ERP) to enhance the potentials of ERP system impact and optimise organisational performance. Implementing ERP system creates immense benefit to organisations, as seen within the developed countries. Findings showed that Nigeria manufacturing organisations encounter internal and external

challenges. The challenges include limited basic infrastructure and economic viability, which may direct or indirectly affect business performance. Blockchain integration with the enterprise resource planning is designed as an optional update with the ERP system provided over the Cloud.

Organisations in the developing countries are working hard to catch up with ever changing global market trend and business operation to achieve competitive advantage. Cloud ERP appears affordable for SMEs and appeared to have gain recognition within the Nigeria manufacturing environment. However, the issue of cost and funding still remains very significant for ERP adoption. But despite various factors that influences ERP adoption within the NMO, organisations realise the need to understand, adopt and implement ERP systems. Therefore, the research findings add to the body of knowledge towards the potential adoption and existing implementation updates by investigating factors influencing adoption, critical success factors and ERP implementation impact.

A comprehensive study using the mixed method was carried out by initially using a stratified sampling technique which is a type of quantitative probability sampling method (Blackstone, 2012) to carry out the main distribution of online questionnaire survey and purposive sampling for qualitative studies because the number of participants is not a fixed/strict prerequisite, which allows adequate data collection until saturation is reached. The method provided an intensive understanding of the research problem and answers to the research questions. Based on the research findings a unique framework of ERP system integrated with blockchain was proposed, which could be more suitable for NMOs considering various challenges including corruption practices.

The proposed framework was eventually validated by collecting and analysing quantitative data from selected MNOs. The validation was established on the views of participants who are

experts and top manager of the organisations. The validation was in form of descriptive study, which aim was to present the improvement found in each functional units of the manufacturing organisation. The study discussed the use of balanced scorecard to measure business performance by exploring the financial (profitability), internal processes, customer satisfaction, employees learning and growth. All relevant influencing factors were explored to implement the framework to suit the MNO.

The organisations in the validation stage appeared to be eager and willing to have a B-ERP update implemented to achieve improved business performance. However, as insinuated the impact was more felt within the inventory and financial units in the participating organisations. The studies show overall improvement in business performance, evidently seen in the functional unit statistical evaluation and user's satisfaction. The studies also identified that there is high resistance to change from the organisations and the employees when it comes to new technologies. Other concerns identified was lack of financial strength, employee's awareness of the updates in-place. However, the participants were able to have the upgrade at no cost for test run. There was mutual understanding between the ERP vendor (Supplier) and ERP organisation (Customer) because ERP selection in this region is basically on vendor reputation. The top management decision majorly influenced the B-ERP upgrade in the participating organisations.

In conclusion, the research problem was stated as the underperformance of the Nigeria manufacturing sector towards the economy. The research is tailored towards Nigeria's Economic Growth and Recovery Plan (EGRP). Therefore, the research seeks to investigate how properly implemented Enterprise resource planning (ERP) system could impact the manufacturing organisations towards overall organisational performance, enhanced profitability, and productivity. The research was assessed using a mixed method which

involves the qualitative and quantitative research approach. These approaches contribute immensely towards a comprehensive data collection. The findings of this research show that some of the main factors that hinders ERP success are poor or improper implementation, corrupt practices at different level and lack of performance measurement.

Hence, the research adopted few procedures to re-design ERP implementation. These include lean, Kanban and six sigma project management tools to efficiently implement ERP system throughout the life cycle of the software within the NMOs. Also, the issue of corruption practices was tackled by the introduction of blockchain technology, especially the immutable functionality of distributed ledger was very instrumental in B-ERP model design. Lastly is the performance measurement using the balanced scorecard. The effective placement of these procedures produced positive impact according to the findings from the validation study.

## **8.2 Recommendations**

It is important to pinpoint some issues that was not mentioned during the interview analysis. However, a summary solution to these issues can still serve as very important recommendations in this research. The findings show that most of the companies within the Nigeria manufacturing environment have not fully maximised their potentials irrespective of the technology they have in place. Some of the following recommendations are extracted from lean and six sigma process improvement tools.

### **8.2.1 Improve business process**

Technology is not helpful when it does not fit with the business processes. Standardizing and improving business processes across the board is very important, some participants described and explained how they still have broken business processes. They explained that some process within the organisation are manual while some are automated because staffs are not confident using the technology or resistance to change. In this situation the organisation needs to take

time to get the processes in-line with the technology, to enable efficiency and potential improvements required.

The organisation can standardize their processes by identify what slows the down the process (Bottle-necks), eliminate process delays and reduce variability. To achieve these concepts, it is important to follow the steps below:

- ❖ **Define** issues and identify improvement opportunities based on customers requirement.
- ❖ **Measure** all of the current process outputs as a reference point.
- ❖ **Analyse** the data to pinpoint the bottle-necks such as faulty equipment.
- ❖ **Improve** the process by making necessary changes.
- ❖ **Control** the said changes to maintain consistent future performance

### 8.2.2 Overall examining of the organisation

The organisations need to be restructured if need be. The findings show that many responsibilities are not clearly assigned. When roles and responsibilities are not clearly defined about who is responsible for what. It is necessary to re-structure, re-assigned and amend how the business is organised. Establishing a governance grid for responsibility and involvement that allows performance tracking. Each member of staff has a role in sustaining success within the organisation. Step to be taken include:

- ❖ Accept responsibility.
- ❖ Monitoring, responding, and managing.
- ❖ Embracing change and continuous learning.
- ❖ Sharing best practices (Knowledge transfer).
- ❖ Replication or expansion of effective results.

Also, there may be needed to train and re-train the employees. To get more from people and to effectively restructure the organisation, it is important to create an effective learning environment to enable good use of the technology in place.

### **8.3 Limitations**

This study is mainly centred on the ERP systems implementation and model redesign within the Nigeria manufacturing organisation only. The findings are not detailed enough into some specifics such as “blockchain technology” and the re-design influence on industry 4.0 in order to assess the entire benefits of B-ERP model integration.

- ❖ The level of knowledge, training, and experience on ERP Implementation in other sectors that may possibly influence ERP success outcome were not considered in this research.
- ❖ Unlike the initial data collection in this study the second phase of data collection in the validation was not based on face-to-face interview with the participants or observation it was solely quantitative due to time and covid-19 restrictions.
- ❖ A comparative study of B-Organisational Performance was meant to be carried out in the United Kingdom but was not done due to covid-19 pandemic
- ❖ The complexity in integrating blockchain framework with an existing ERP system was not examined. Other factors such as cost, compatibility and other issues were not considered. Information from the viewpoint of the vendor was not presented in this study.
- ❖ Also, organisations operating a small-box or open source ERP solutions which rarely have a well-standardized integration interface for upgrades were not examined.
- ❖ The data collection is solely relied on the information gathered from participating organisation’s management and workers. As a result of varying level of knowledge and experience in ERP implementation, there may be bias, due to individual views and other unforeseen perception on organisation’s business performance, respectively.

#### 8.4 Contribution and Further Study

ERP implementation is relatively in its infancy stage in developing countries. Its adoption and implementation may be of great influence on MNOs contribution to the countries overall GDP. The insufficient amount of research materials is a major drawback in this area. Hence this study adds to the body of Knowledge on ERP adoption and implementation within the Nigeria manufacturing organisations. The research was also able to contribute to knowledge by thoroughly and extensively examining the research issues via analysing face-to-face interview and quantitative statistical analysis as a mixed method. The technology implementation barriers and factors influencing, and impeding ERP system adoption were recognised.

Also, this study contributes to body of knowledge by identifying that significant gap exists in the critical success factors that influence the success of ERP system within the Nigeria manufacturing organisations. The study presented implementation framework to enhance success of a blockchain ERP model. Validation study of B-ERP revealed that MNOs that experimented the proposed model achieved drastic improvement within their functional units and manufacturing operations. Some of the benefits include reduced manufacturing costs, enhanced supply chain, and reduced delivery time.

Lastly, the following bullet points are for the further research suggestions:

- ❖ Further exploration of the critical success factors for B-ERP implementation.
- ❖ Examine the effect of B-ERP implementation approach within other sectors in Nigeria
- ❖ Investigate the integration of blockchain in the on-premise and open-sources ERP systems.
- ❖ The inherent complexity on blockchain integration into ERP systems, should be examined which will be the viewpoints of vendors efforts on ERP improvement.

- ❖ The future research can go as far as gathering a reasonable feedback from various agencies such as government, ERP vendors, ERP customers, ERP consultants' academics or industrial experts.

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## **Appendix 1**

### **ERP SURVEY QUESTIONNAIRE**

**Dear participant,**

Thank you very much for agreeing to participate in this survey. You are invited to participate in a ten minutes web based online survey which is designed to [Investigate the implementation of a re-designed ERP software within the Nigeria manufacturing organisations.

The information provided by you in this questionnaire will be used for research purposes. The information collected will abide by the GDPR data protection policies. It will only be used for the purpose of this research and identification of individual participants will not be disclosed. Anonymised research data may be archived at the University Data Archive in order to make them available to other researchers in line with current data sharing practices.

Thank you.

Name: Obafemi .M. Oyewole,

e-mail: [obafemi.oyewole@pgr.aru.ac.uk](mailto:obafemi.oyewole@pgr.aru.ac.uk)

Faculty: Faculty of Science and Technology

Anglia Ruskin University United Kingdom

### Survey Questionnaire:

#### **Investigating and Implementation of a Redesigned ERP Software in Nigeria and Comparing Organisational Performance between Nigeria and United Kingdom**

#### SECTION 1: General Information

- 1) Please indicate your regional part of Nigeria.

- North East
- North West
- North Central
- South East
- South South
- South West

2) What is your company's Product Category?

- Agricultural
- Automobiles
- Construction
- Domestic
- Electrical and Electronic
- Food Drinks and Tobacco
- Print and Ink
- Steel and Metal
- Others please specify-----

3) What is your level of authority in the organization?

- Top Manager
- Middle Manager
- Line Manager
- Team Manager
- Others please specify -----

4) Does your Organization use Enterprise resource planning (ERP) system?

- If 'Yes' please attend section 3
- If 'No' please attend section 2

## SECTION 2: Non-ERP User/Prospective Users

5) What capacity can your organisation be classified in?

- Large size: Greater than 250 employees or revenue of greater than £22.8m/\$22.8m
- Medium size: Between 50 and 250 employees or revenue of greater than £5.6m/\$5.6m and less than £22.8m/\$22.8m
- Small size: Between 10 and 50 employees or revenue of greater than £2m/\$2m or less than £5.6m/\$5.6m
- Micro size: Less than 10 employees or revenue of lesser than £2m/\$2m

6) Identify the significant factors affecting the adoption of modern IT in your organization

- Cost and Funding

- Available Infrastructure
- Skills and training
- Management Support
- Government policies and support
- Business size
- Trust and Reliability

7) Rate the following features of enterprise management system according to their level importance to your organisation.

	<b>First</b>	<b>Second</b>	<b>Third</b>	<b>Fourth</b>	<b>Fifth</b>	<b>Sixth</b>	<b>Seventh</b>
Cost of implementation	<input type="checkbox"/>						
Graphics	<input type="checkbox"/>						
Real time information	<input type="checkbox"/>						
Management decision accuracy	<input type="checkbox"/>						
User friendly/Less complex	<input type="checkbox"/>						
Unified database access	<input type="checkbox"/>						
Effectiveness and efficiency	<input type="checkbox"/>						

8) There are many advantages of ERP few of which are list below. Kindly indicate if applicable to the status of your organisation with the incumbent management practice.

- Responsiveness to change in a competitive environment
- Employees development
- Inventory accuracy
- Unified database access
- The use of modern IT system
- Strong leadership and Management decision accuracy
- Entire Organisation real time uniform communicate
- Supply chain efficiency
- Team working efficiency

9) Identify the most important drive that propels Improving business processes in your organisation?

- Customer requirement and satisfaction
- Process improvements towards profit
- Job satisfaction
- Technological advancement
- Maintaining your competitive advantage
- All of the above
- Other:

10) Kindly select the most challenging area to manage in your Organisation

- Accounting and Finance
- Human resource and Payroll
- Sales and Marketing
- Inventory/Stock Management
- Manufacturing and Production
- Customer resource management
- All of the above
- Other:

### SECTION 3 Enterprise Resource Planning Organisation (ERP User)

11) Please indicate your enterprise resource planning (ERP) knowledge level

- ERP Beginner
- Intermediate ERP user
- Expert ERP user
- Vendor reliant
- I am not sure

12) How long have you been using ERP?

- 1-3 years
- 3-5 years
- Over 5 years
- I am not sure

13) What are the means of ERP maintenance and support available for your organization?

- Vendor support
- ERP specialist consultants
- ERP Trained staffs
- I am not sure

14) Was your entire organisational process re-engineered?

- Yes
- No
- I am not sure

15) What category of ERP system is adopted in your organization?

- Client, server, and database (On premise)
- Cloud based ERP system (Web based/EDI)
- I am not sure

16) Was there any additional security measures put in place during ERP implementation?

- Yes
- No
- I am not sure

17) How successful can you classify the ERP system in your organisation?

	1	2	3	4	5	
<b>Failed</b>	<input type="checkbox"/>	<b>Successful</b>				

18) Does your organization engage the services of business process management consultants and specialists for advice on implementation?

- Yes
- No
- I am not sure

19) Does a considerable percentage of your employees understand the Enterprise resource planning system?

- Yes
- No
- Average
- Few
- I am not sure

20) Does your organisation set out time and programs that continuously training and document employee responses to ERP?

- Yes
- No

I am not sure

## DESIGN INTERVIEW QUESTION

### **Informed Consent Form/ Interview invite brief**

Dear Sir/ Madam,

I hope this message finds you well.

I would like to invite you to participate in an academic research interview. I am currently PhD student at Anglia Ruskin University. The purpose of this survey is to investigate Information technology improvement. The information provided will be used as the foundation for the preparation for further questions. The purpose of this Interview is to investigate and

assess the level of Enterprise resource planning (ERP) system adoption within the Nigeria manufacturing organisations.

The information collected from this interview will be strictly for the purpose of this research such as to answer research questions towards completing doctoral thesis at Anglia Ruskin University, United Kingdom. All individual references in the analysis will remain anonymous throughout the research. That is the real names of participants will not be used neither in the thesis nor in any related work and participant's organisations will be represented by the category of manufacturing product. The interview is scheduled to take within 40 – 60 minutes to complete. If you have any questions regarding this interview or wish to take a break or even stop at any point, please do not hesitate to let your intention known.

Thanks, and your assistance is high appreciated.

Interviewer: **Obafemi Meredith Oyewole**

e-mail: [Obafemi.oyewole@pgr.aru.ac.uk](mailto:Obafemi.oyewole@pgr.aru.ac.uk)

Faculty: **Faculty of Science and Technology**

Institution: **Anglia Ruskin University**

Date:

Participant Name and Signature:

Job Role in Company:

Job Role in Company:

## SECTION 1

- 1) Please describe the use of Information system (IS) in your organisation.
  - Enterprise resource planning system (Integrated Systems)
  - Organisation stand-alone systems
  - Other information systems (please specify)
  - No computerised solutions (i.e. manual systems only)

- 2) Are you willing to provide further information in this interview about question (1)?
- Yes
  - No
- 3) If there is no Information system (IS) in place, is your organisation planning to implement an integrated information system?
- Yes
  - No
- 4) If your organisation has integrated information system. Would you like to upgrade your current software, or enhance it efficiency towards business profitability?
- Yes
  - No

## SECTION 2

1. What is your company's Product Category? (e.g. Agricultural, Automobiles, Domestic, Food Drinks and Tobacco)
- 
2. Kindly mention the main departments within your organization. (e.g. HR, sales & Marketing, finance and so on)
- 
3. Does your company have other sites/branches/locations both national and internationally?
- 
4. Do you have staff that work remotely such as working from home?
- 
5. How can you categorise your organisation's size? (Small, Medium, or Large)
- 
6. Briefly describe the main business challenges within your organisation.
- (Files/documents/reports duplication, lack of central database, Separated business processes, Little or no remote access to company information, Lack of real-time information)
-

7. If your organisation uses ERP can you say that your organisation is more profitable after ERP adoption?

---

8. What type of ERP implementation do you have? (Cloud or On-premise)

---

9. Kindly describe challenges with data accuracy and integrity within your organisation? (If any)

---

10. Additional to ERP software database is there other external storage or backup?

---

11. Please explain the data transformation process challenges during ERP implementation. (if any)

---

12. What are the factors that influenced ERP system adoption? (Adoption reasons or criteria).

---

13. Briefly discuss your ERP vendor selection criteria.

---

14. Which modules did your organisation implement and what are the challenges implementing them?

---

15. Briefly explain what project management technique or tools was used during the ERP implementation project?

---

16. Briefly discuss the data migration process. What are the challenges encountered transferring data and receiving data?

---

17. Do you assign process owners within the team to monitor and lead each process?

---

18. What was the overall cost of implementation?

---

19. What are the critical success factors of your ERP implementation? Please explain what you think you have done correctly and incorrectly.

---

20. Do you believe the current network architecture is fits for purpose or are you looking for some further upgrades in the future? Please explain.

---

21. Do you believe the current network architecture support the organisation's strategies?

---

22. In conclusion, kindly explain recommendation as regards ERP implementation within the Nigeria manufacturing Organisations. (Features you would like to see in ERP software)

## **ERP VALIDATION QUESTIONNAIRE**

**Dear participant,**

Thank you very much for agreeing to participate in this survey. You are invited to participate in a ten minutes web based online survey which is designed to validate the implementation of a re-designed ERP software in your organisations. The information provided by you in this questionnaire will be used for research purposes. The information collected will abide by the GDPR data protection policies. It will only be used for the purpose of this research only and participants informations will not be disclosed. Anonymised research data may be

archived at the University Data Archive in order to make them available to other researchers in line with current data sharing practices.

Thank you.

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## SECTION 1: Demographics

- 1) What is your company's Product Category?
  - Agricultural
  - Automobiles
  - Construction
  - Domestics
  - Electrical and Electronic
  - Food Drinks and Tobbaco
  - Print and Ink
  - Steel and Metal
  - Others please specify-----
  
- 2) What is your level of authority in the organization?
  - Board/ Top Management
  - IT Manager
  - Production
  - Others please specify -----
  
- 3) What category of ERP system is adopted in your organization?
  - Client, server, and database (On premise)
  - Cloud based ERP system (Web based/EDI)
  
- 4) Please specify the level of ERP integration in organisation.

- Completely integrated ERP
- Partially integrated

## SECTION 2: Validation

5) What capacity can your organisation be classified in?

Company Size	Yes/No
Large size: Greater than 250 employees or revenue of greater than £22.8m/\$22.8m	
Medium size: Between 50 and 250 employees or revenue of greater than £5.6m/\$5.6m and less than £22.8m/\$22.8m	
Small size: Between 10 and 50 employees or revenue of greater than £2m/\$2m or less than £5.6m/\$5.6m	
Micro size: Less than 10 employees or revenue of lesser than £2m/\$2m	

6) Identify the improved area within your manufacturing activities.

Improved Area	Yes/no
Effective management decision and insight	
Improved Material Management	
Reduced Lead-Time	
Enhanced Productivity	
Reduced Bottleneck and Downtime	
User-Satisfaction	
Lean Efficient Operations	
Overall Quality Management	
Inventory Level Accuracy	
Streamlined Manufacturing Processes	
Efficient Production Processes	

Proactive Maintenance Activities	
Reduced Delivery Time	
Supply-chain efficiency	

7) Rank the following critical success factors for B-ERP implementation

	<b>Strongly Agree</b>	<b>Agree</b>	<b>Neutral</b>	<b>Disagree</b>	<b>Strongly Disagree</b>
Top management support	<input type="checkbox"/>				
Project management	<input type="checkbox"/>				
Business process reengineering	<input type="checkbox"/>				
Project schedule and planning	<input type="checkbox"/>				
Training and Education	<input type="checkbox"/>				
End-user acceptance and participation	<input type="checkbox"/>				
Knowledge transfer	<input type="checkbox"/>				
Change management	<input type="checkbox"/>				
Organizational fit and adaptability	<input type="checkbox"/>				
Employee enthusiasm	<input type="checkbox"/>				
Cultural readiness	<input type="checkbox"/>				
User friendliness	<input type="checkbox"/>				

8) How successful can you classify the impact of B-ERP on functional units in your organisation

	<b>Strongly Agree</b>	<b>Agree</b>	<b>Neutral</b>	<b>Disagree</b>	<b>Strongly Disagree</b>
Accounting and Finance	<input type="checkbox"/>				
Human resource and Payroll	<input type="checkbox"/>				
Sales and Marketing	<input type="checkbox"/>				
Inventory/Stock Management	<input type="checkbox"/>				
Manufacturing and Production	<input type="checkbox"/>				
Customer resource management	<input type="checkbox"/>				

## Appendix II

### i) Results and Analysis

**Tab 5.3- Descriptive Statistics: Factors influencing ERP adoption**

Variable description	N	Mean	Std. Deviation	Skewness		Kurtosis	
				Statistic	Std. Error	Statistic	Std. Error
'Cost and Funding'	350	1.60	1.209	1.977	.130	2.521	.260
'Enhance production and profitability'	350	1.85	1.303	1.310	.130	.511	.260
'Trust and Reliability'	350	1.89	1.384	1.336	.130	.382	.260
'Management Commitment'	350	2.05	1.450	1.090	.130	-.271	.260
'Effectiveness and efficiency'	350	2.16	1.376	.910	.130	-.344	.260
'Required skills and training'	350	2.99	1.465	.284	.130	-1.383	.260
'User friendly/Less complex'	350	3.06	1.137	.311	.130	-.219	.260
'Information Awareness'	350	3.08	1.430	.142	.130	-1.223	.260
'Management decision accuracy'	350	3.09	1.158	.305	.130	-.379	.260
'Real time information'	350	3.16	1.216	.233	.130	-.687	.260

'IT Infrastructure'	350	3.18	1.337	.110	.130	-1.048	.260
'Unified database access'	350	3.20	1.127	.391	.130	-.519	.260
'Business size'	350	3.21	1.350	.066	.130	-1.082	.260
'Government policies and support'	350	3.22	1.356	.100	.130	-1.107	.260
'Maintaining your competitive advantage'	350	3.39	1.142	.153	.130	-.694	.260
'Simple-user Interface'	350	3.40	1.158	.316	.130	-1.138	.260
'Customer requirement'	350	3.46	1.101	.380	.130	-1.128	.260
'Technological advancement'	350	3.50	1.165	.126	.130	-1.045	.260
'Process improvements'	350	3.54	1.126	.268	.130	-1.338	.260
Valid N (listwise)	350						

### Correlation analysis

		Organisational Performance	'Accounting and finance'	'Human resources and payroll'	'Sales and Marketing'	'Inventory/Stock management'	'Customer resource management'	'Supply-chain management'	ERP user's satisfaction?
Organisational Performance	Pearson Correlation	1	.026	.550	.518	-.088	.710	-.005	-.009
	Sig. (2-tailed)		.690	.038	.031	.171	.006	.943	.889
ERP user's satisfaction?	Pearson Correlation	-.009	.532	.428	.412	.428	-.642	.770	1
	Sig. (2-tailed)	.889	.042	.048	.050	.048	.008	.022	

\*. Correlation is significant at the 0.05 level (2-tailed).

\*\*. Correlation is significant at the 0.01 level (2-tailed).

### Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.567 <sup>a</sup>	.364	.281	.81086

a. Predictors: (Constant), 'Team work efficiency', 'Fit between ERP and business', Training and development', 'User-Satisfaction , Effective Knowledge Transfer, 'Seamless Integration', 'Cultural change readiness', Vendor support', Management support", Quality data management"

**ANOVA<sup>a</sup>**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9.482	10	.948	2.674	.003 <sup>b</sup>
	Residual	327.940	233	1.407		
	Total	337.422	243			

a. Dependent Variable: Organisational Performance

b. Predictors: (Constant), 'Team work efficiency', 'Fit between ERP and business', Training and development', 'User-Satisfaction , Effective Knowledge Transfer, 'Seamless Integration', 'Cultural change readiness', Vendor support', Management support", Quality data management"

**Coefficients**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.095	.392		10.457	.000
	'Fit between ERP and business'	.005	.062	.005	.080	.937
	Effective Knowledge Transfer	1.073	.357	-.490	-2.275	.014
	'User-Satisfaction	.465	.161	.252	-1.758	.019
	Vendor support'	.059	.087	.064	.685	.494
	Quality data management"	1.065	.361	.452	3.758	.009
	Management support"	.629	.278	-.152	-1.643	.021
	'Cultural change readiness'	.325	.121	.332	-1.112	.039
	'Seamless Integration'	.051	.078	.331	.147	.195
	Training and development'	.549	.057	.062	.867	.001
	'Teamwork efficiency'	.465	.161	.252	-1.758	.019

a. Dependent Variable: Organisational Performance

## ii) Results and Analysis

Tab 7.1 What is your level of authority in the organisation?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Board/ Top Management	73	73.0	73.0	73.0

IT managers	16	16.0	16.0	89.0
Production managers	11	11.0	11.0	100.0
Total	100	100.0	100.0	

Tab 7.2 What is your company's product category?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agricultural	32	32.0	32.0	32.0
	Automobiles	5	5.0	5.0	37.0
	Construction	5	5.0	5.0	42.0
	Domestics	28	28.0	28.0	70.0
	Electrical and Electronics	3	3.0	3.0	73.0
	Food, Drinks and Tobacco	10	10.0	10.0	83.0
	Print and Ink	13	13.0	13.0	96.0
	Steel and Metal	4	4.0	4.0	100.0
	Total	100	100.0	100.0	

Tab 7.3: Descriptive Statistics for B-ERP adoption influence

	N	Mean	Std. Deviation	Skewness		Kurtosis	
				Statistic	Std. Error	Statistic	Std. Error
"Company Strategy"	100	1.72	1.092	1.529	.241	1.416	.478
"Top Management"	100	2.21	1.559	.948	.241	-.679	.478
"Stakeholders insight"	100	1.22	.773	4.014	.241	16.270	.478
"Knowledge transfer"	100	2.20	1.271	.939	.241	.061	.478
"Business process reengineering"	100	2.31	1.134	.378	.241	-.317	.478
"Employee participation"	100	1.09	.404	4.451	.241	18.547	.478
"Reliability, effectiveness and efficiency"	100	1.45	.783	1.841	.241	3.534	.478
"Training and Education"	100	2.17	1.280	1.091	.241	.309	.478

"User friendliness	100	2.31	1.293	.660	.241	-.404	.478
"Production and profitability"	100	1.95	1.067	.712	.241	-.246	.478
Valid N (listwise)	100						

Tab 7.5: \$Impact\*ERP success Impact Crosstabulation

			How successful can you classify the re-design ERP system?					
			Satisfactory	Above Average	Average	Below Average	Non-Satisfactory	Total
Organisational Performance on functional units <sup>a</sup>	'Accounting and finance'	Count	62	9	15	1	7	94
	'Human resources and pay roll'	Count	24	3	6	0	4	37
	'Sales and Marketing'	Count	24	3	6	0	4	37
	'Inventory/Stock management'	Count	62	9	15	1	7	94
	'Customer resource management'	Count	24	3	6	0	4	37
	'Supply-chain management'	Count	52	6	14	1	6	79
<b>Total</b>	<b>Count</b>		<b>64</b>	<b>9</b>	<b>15</b>	<b>1</b>	<b>7</b>	<b>96</b>

Percentages and totals are based on respondents.

a. Dichotomy group tabulated at value 1.

Tab 7.6 Regression coefficient

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound

1	(Constant)	5.214	.890		5.859	.000	3.426	7.002
	"Company Strategy"	.505	.121	-.252	- 1.692	.000	-.448	.038
	"Top Management"	.419	.097	.205	1.225	.000	-.076	.315
	"Stakeholders insight"	.536	.194	-.206	- 1.218	.000	-.625	.153
	"Knowledge transfer"	.412	.136	-.060	-.311	.000	-.315	.231
	"BPR"	.621	.138	-.159	-.883	.042	-.398	.155
	"Employee participation"	.735	.312	.114	.753	.000	-.392	.863
	"Reliability, effectiveness and efficiency"	.641	.253	-.101	-.557	.000	-.648	.367
	"Training and Education"	.450	.111	-.371	- 2.251	.029	-.474	-.027
	"User friendly/Less complex"	.509	.125	-.014	-.073	.000	-.260	.242
	"Production and profitability"	.424	.139	.146	.892	.000	-.155	.403
	'Inventory/Stock management'	.550	.626	.012	.080	.000	-1.209	1.308
	'Customer resource management'	.304	.288	.160	1.056	.029	-.275	.883
	'Supply-chain management'	.834	.353	-.064	-.379	.007	-.844	.576

a. Dependent Variable: How successful can you classify the re-design ERP system?

**Tab 7.7 Regression coefficient**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	5.214	.890		5.859	.000	3.426	7.002
	"Company Strategy"	.505	.121	.252	1.692	.000	-.448	.038
	"Top management support"	.419	.097	.205	1.225	.000	-.076	.315
	"Stakeholders insight"	.536	.194	.206	1.218	.000	-.625	.153
	"Knowledge transfer"	.412	.136	.060	.311	.000	-.315	.231
	"BPR"	.621	.138	.159	.883	.042	-.398	.155
	"Employee participation"	.735	.312	.114	.753	.000	-.392	.863
	"Trust basis and Reliability"	.641	.253	.101	.557	.000	-.648	.367

"Training and Education"	.450	.111	.371	2.251	.029	-.474	-.027
"User friendly/Less complex"	.509	.125	.014	.073	.000	-.260	.242
"Production and profitability"	.424	.139	.146	.892	.000	-.155	.403
'Inventory/Stock management'	.550	.626	.012	.080	.000	-1.209	1.308
'Customer resource management'	.304	.288	.160	1.056	.029	-.275	.883
'Supply-chain management'	.834	.353	.064	.379	.007	-.844	.576

b. *Dependent Variable: Organisational performance*

### Correlations

		ERP_Impact	ERP_user_sat
ERP_Impact	Pearson Correlation	1	.032
	Sig. (2-tailed)		.748
ERP_user_sat	Pearson Correlation	.032	1
	Sig. (2-tailed)	.748	
Impact_Acc	Pearson Correlation	.823	.654
	Sig. (2-tailed)	.000	.000
Impact_HRM	Pearson Correlation	.845	.912
	Sig. (2-tailed)	.000	.000
Impact_SM	Pearson Correlation	.345	.740
	Sig. (2-tailed)	.042	.002
Impact_Invent	Pearson Correlation	.890	.872
	Sig. (2-tailed)	.000	.000
Impact_CRM	Pearson Correlation	.429	.911
	Sig. (2-tailed)	.000	.000
Impact_Supply	Pearson Correlation	.680	.814
	Sig. (2-tailed)	.003	.000